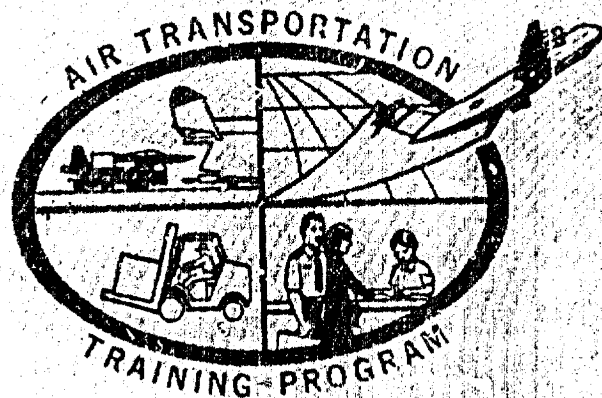
EVALUATION OF THE PROTOTYPE AIR TRANSPORTATION COMPUTER-BASED TRAINING (ATCBT) SYSTEM

FINAL REPORT



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Prepared for:

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EXECUTIVE SUMMARY

Instructional Science and Development, Inc. (ISD, Inc.) has been under contract to Headquarters, Military Airlift Command (HQ MAC) to develop, implement, and validate a prototype Air Transportation Computer-Based Training (ATCBT) system for use in providing initial, recurring, and upgrade training for MAC aerial port (AFSC 605XX) personnel. The goals established for the prototype training system are to; (1) support personnel development, (2) qualify personnel to perform work assignments, (3) establish minimum requirements for personnel qualification for specific duties, and (4) identify personnel job training needs.

To achieve these training goals, the prototype CBT system was designed to meet the following criteria:

1. Integrate training content from the formal schools, on-the-job training (OJT), Career Development Courses (CDCs), and the Unit Learning Centers (ULCs).

2. Present interactive, performance-based training at the 9th grade reading level.

3. Develop competency-based training using standard Instructional Systems Development (ISD) procedures.

4. Provide self-paced training modules to minimize supervisory involvement.

5. Provide job specific training information for trainees and training management information for supervisors.

6. Deliver training to the work station where it is easily accessible.

7. Standarize training across aerial ports to meet training requirements for both active and reserve forces.

The contract Statement of Work specified three ATCBT system components: delivery, production, and management. The operational concept for the training environment is decentralized CBT delivery components at the aerial port work stations, a centralized CBT production component at the MAC Module Development Center (MDC), and automatic generation of training management information for the local aerial ports, the MDC, and other managerial units such as HQ MAC and Numbered Air Forces. The purpose of the prototype implementation was to evaluate this operational concept at three aerial ports, each with differing mission requirements, and at the MDC.

Five tasks were scheduled for completion during the first 15 months of the three-year contract. Task 1 was to identify the prototype system design and develop plans for implementation. Task 2 was to perform a task and media analysis to define the training requirements. Tasks 1 and 2 were performed concurrently to ensure that the system was designed to meet the training requirements. Task 3 was to implement the production component at the MDC located at Travis AFB, California. Task 4 was to implement the prototype

delivery system at three aerial ports sites: Charleston AFB, South Carolina; Dyess AFB, Texas; and Rhein Main AB, Germany. Task 5 was to validate and evaluate the ATCBT system at the three field sites and the MDC.

The purpose of the final report is to document the results of the prototype evaluation, present recommendations on the basis of the evaluation results, and provide a command-wide implementation plan. This report is organized into three major sections. Section 1.0 describes the project background and provides a description of the activities conducted during each of the five tasks. Section 2.0 presents the prototype evaluation results and recommendations. It is organized by the three ATCBT system components: delivery, management, and production. Section 3.0 provides the command-wide implementation plan.

Background

At the request of the Secretary of the Air Force, a series of studies was performed by the USAF Scientific Advisory Board, the DCS/Air Transportation, and a commercial firm under contract to MAC. These studies identified deficiencies in training the Air Transportation career fields and provided recommendations to improve the training. The training deficiencies in the aerial port squadrons fell into several major categories: (1) the need to integrate the Unit Learning Center (ULC) and on-the-job training (OJT) functions, (2) the need to provide standardized, performance-based training and meaningful training data to management at various levels, and (3) the need to upgrade the training technology used in the field. Slide/tape training is currently used at the ULC. This training technology has the following drawbacks: (1) it is a passive rather than an active learning environment, (2) it does not provide any feedback to the trainee or the supervisor, (3) it is difficult to keep current, and (4) it is not easily accessible from the work stations. The prototype ATCBT evaluation project was structured to correct these training deficiencies.

Prototype System Design

The operational concept of decentralized CBT delivery components, a centralized production component, and a management component which functions in the background was the basis for the prototype system design. To satisfy this concept, it was necessary to identify a basic system configuration with enough flexibility to be tailored to meet the specific ATCBT training environment. A survey of packaged CBT systems (those commercially available systems providing both hardware and software) clearly convinced the design team that a packaged CBT system would force the training environment to fit the hardware and software rather than the other, more appropriate, direction of fitting the system to the training needs. A "systems integration" approach was adopted in the belief that integrating commercially available, off-the-shelf components would best allow a design which served the intended user.

Within this systems integration approach, ISD, Inc. established the following design criteria:

1. Transportability. The capability to execute the software on a "family" of compatible microcomputers was required to eliminate dependency on a single manufacturer. The flexibility to modify the basic configuration to meet the needs of different aerial port sizes and missions was seen as mandatory.

2. User-Friendly. New skills for using the training were undesirable. Student interaction should require minimal skills and the training should be accessible at the work station. The use of non-programmers as authors was a necessity in order to allow development and maintenance of lessons in-house by MAC air transportation personnel.

3. Adequate Training. A match between system features and critical instructional characteristics (including media) was required to provide effective, low-cost training for the specific training applications. Training should tie directly to job requirements and be standard across the career field.

4. Design-to-Cost. The approach was to minimize development costs through use of off-the-shelf hardware/software and minimize training equipment maintenance and operation costs.

Task and Media Analysis

A task analysis was performed to identify training requirements and to select tasks for training for both the prototype evaluation and command-wide implementation. A media analysis was performed to identify the media attributes required to meet the instructional characteristics and to define the mix of media to accomplish the training requirements.

In order for the ATCBT system to be accepted and useful at the aerial ports, it had to specifically meet AFSC 605XX training requirements. These training requirements are published in the Specialty Training Standards (STSs) that designate tasks which must be trained in order to progress in the career field. As outlined in the STSs for AFSC 605XX, the primary focus of OJT is to take the basic Air Transportation Training Command (ATTC) graduate entering the squadron at a 3-skill level to a 5-skill level. The introduction of delivery stations at the work centers provides OJT supervisors with a resource to accomplish this training. The CBT lessons used in combination with hands-on training minimize the time required by the OJT supervisor to ensure proficiency requirements are satisfied. Although the primary intent of ATCBT instruction is to provide 3- to 5-skill level training, it can also be used to provide proficiency training, recurring training, refresher training for other levels, and cross-training at the 7-skill level (Air Transportation Supervisor--AFSC 60572).

Production Component Implementation

Implementation of the production component consisted of a number of subtasks. These included:

1. Development of the authoring environment for the MDC to use.

2. Development of the prototype ATCBT lessons.

3. Validation of the prototype lessons.

4. Installation of three ATCBT systems at Travis AFB.

5. Training the MDC staff in analysis, design, and authoring procedures and in the use of the data management functions.

The first three subtasks are described in detail in Section 1.0. Training the MDC staff was an ongoing activity. ISD, Inc. personnel worked closely with the MDC personnel at all stages of the production component implementation. The MDC inputs were essential in the development of a useful authoring environment. Their expertise and review comments were also necessary in the development and validation of the prototype lessons.

Prototype Site Implementation

Three aerial ports with differing missions were specified as prototype implementation sites to test the ATCBT concept of operation. Charleston AFB, South Carolina represents a major strategic port responsible for moving a large number of passengers and cargo in support of the MAC mission. Dyess AFB, Texas represents a mobile aerial port that provides a training environment unique to mobility planning and operations. Rhein Main AB, Germany represents a major strategic port operating in a non-CONUS environment.

An ATCBT Implementation Plan was developed to define: (1) ATCBT training organization, roles and responsibilities, (2) training and job aids for ATCBT users, (3) facility preparation requirements, including environmental considerations, power requirements, base communications requirements, (4) maintenance support requirements, including preventive and corrective maintenance procedures, and (5) the plan for prototype system validation. In addition, ISD, Inc. prepared a User's Guide for Prototype Evaluation and Validation for use by the ULC monitor.

The ATCBT systems were installed at the prototype sites during the period June through August 1985. This schedule allowed up to 26 weeks for the evaluation period. ISD, Inc. personnel, in conjunction with personnel from HQ MAC and the MDC, spent a minimum of one week per site for ATCBT system implementation. Activities included:

1. Physical installation of the hardware and software.

2. System testing.

3. Training the ULC monitor and designated personnel on procedures for taking lessons, generating reports, managing training data, preventive and corrective maintenance, and collecting validation data.

4. Briefing aerial port squadron supervisors on the availability of the training system at their work stations.

Prototype System Evaluation

The last task was to validate and evaluate the prototype system at the three aerial ports and the MDC. The purpose of the evaluation was to determine the effectiveness of the prototype ATCBT system in providing initial, recurring, and upgrade training for MAC aerial port personnel. The evaluation was not designed to measure the effectiveness of CBT as a medium versus other media. It was designed to evaluate the effectiveness of integrating CBT into the OJT environment.

Evaluation of the prototype delivery and management components required inputs on use and acceptance by trainees, the ULC monitor, and the work station supervisors. Four data collection tools were provided: (1) automatic data collection provided as part of the prototype CBT lessons, (2) questionnaires administered to trainees after completion of individual lessons, (3) surveys administered to ULC supervisors, and (4) system use logs. Evaluation of the production component included interviews with MDC personnel and an ATCBT authoring system log maintained throughout the evaluation period.

The results indicated that:

1. CBT is effective in delivering OJT instruction at local work stations.

2. Reliability and maintainability of the CBT system components in a 24-hour operation at work stations is satisfactory.

3. The centralized CBT lesson production component is operational.

4. The ATCBT authoring environment can be used by non-programmers.

5. The management component for collecting data in the background works in several situations, but is limited in bases which have mechanical PBXs.

6. Collecting, consolidating, and disseminating training management information in the form of printed reports at the local level is useful. However, the OJT and section supervisors require more detailed training information.

7. The prototype ATCBT system minimizes supervisor time needed for training, requires no additional manpower and little additional skills training.

Command-Wide Implementation Plan

The proposed plan for command-wide implementation of the ATCBT system is is based on the requirements in the contract Statement of Work, the results and recommendations of the prototype ATCBT system evaluation, and discussions with HQ MAC personnel. It represents the best current efforts of ISD, Inc. to specify all of the events which must occur and propose a tentative schedule to accomplish these events. Implementation of the plan is subject to approval by HQ MAC.

The scope of the command-wide implementation is to install ATCBT systems at 41 sites worldwide with an inventory of approximately 200 hours of CBT instruction to provide initial, recurring, and upgrade training for AFSC 605XX personnel. The proposed schedule for ATCBT installation command-wide covers the period from 1 April 1986 to 15 February 1988.

SECTION 1.0

PROTOTYPE ANALYSIS AND DEVELOPMENT

Instructional Science and Development, Inc. (ISD, Inc.) has been under contract to Headquarters, Military Airlift Command (HQ MAC) to develop, implement, and validate a prototype Air Transportation Computer-Based Training (ATCBT) system for use in providing initial, recurring, and upgrade training for MAC aerial port (AFSC 605XX) personnel. The goals established for the prototype training system are to: (1) support personnel development, (2) qualify personnel to perform work assignments, (3) establish minimum requirements for personnel qualification for specific duties, and (4) identify personnel job training needs.

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The purpose of this report is to document the results of the prototype evaluation, present recommendations on the basis of the evaluation results, and provide a command-wide implementation plan for the follow-on contract period. This report is organized into three major sections. The remainder of Section 1.0 describes the project background and provides a description of the activities conducted during each of the five tasks. Section 2.0 presents the prototype evaluation results and recommendations. It is organized by the three ATCBT system components: delivery, management, and production. Section 3.0 provides the command-wide implementation plan.

1.1 Background

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4. Design-to-Cost. The approach was to minimize development costs through use of off-the-shelf hardware/software and minimize training equipment maintenance and operation costs.

The prototype system design was based on a survey of commercially available hardware and software, including tests and demonstrations, and the results of the task and media analysis described in Section 1.3 below. The media analysis indicated that the use of medium resolution color graphics and keyboard input were sufficient to meet the learning objectives defined for ATCBT.

To meet the design criteria of transportability adequacy and design-to-cost, an IBM PC clone was selected as the core of the prototype system. This decision was based on the following factors.

1. Runs under MS-DOS to ensure compatibility.

2. Faster and cheaper than IBM-PC (based upon a request for quotes and GSA schedules).

3. Runs a large number of authoring languages.

Specifically, the AT&T 6300 personal computer was selected because of its highly rated color display monitors and maintenance support.

Likewise, the selection of the authoring software was based on the design criteria of transportability, user-friendliness, and design-to-cost. Specifically, CDS II (Courseware Design System), developed by Electronic Information Systems, Inc., was selected for the following reasons:

1. Written in C so it is highly transportable across a number of microcomputers.

2. Lessons developed on one system run on other systems.

3. Instructional paradigms are not fixed.

4. Command language for programmers and a "meta-language" to build authoring interactions for non-programmers.

5. Features for recording specified data which can be processed by tailored data base management programs.

6. Moderate costs for authoring and delivery software.

As shown in Table 1-1, the delivery component is designed to represent a standardized configuration which can be scaled to any size port. The production component parallels the delivery component, but includes features specific to the authoring process. The management component is based on the delivery component, but includes several additional features to permit the transmission of data to points outside the port and generation of reports for distribution to the port. This includes a draft quality printer, modem, data management software (dBase II for the prototype), communications software, and the CONTROL software developed by ISD, Inc.

The production component includes the capability to develop graphics in support of the lesson content. The cost and complexity of the graphics software available to run on the AT&T 6300 under MS-DOS, as well as the options for input devices, varied considerably. PC Paint (developed by Mouse systems, Inc.) was selected for the following reasons:

1. Resolution supported the training requirements.

2. Compatible with AT&T 6300 standard graphics board.

3. Supports optical mouse for input without additional interface boards or power requirements.

4. Creates picture files accessible by CDS II authoring software.

5. Picture file storage compressed to save space on disk.

6. Provides icon menu command structure.

7. Low cost.

Figure 1-1 graphically illustrates the ATCBT prototype system design. The development and maintenance of CBT lessons by non-programmer MAC personnel is accomplished through the production component at the MDC. However, it is the management component that makes the ATCBT system unique. A significant feature is the transmission of data from the delivery stations at the work centers to the management component at the ULC, and subsequently through the Defense Data Network (DDN) to the MDC (and HQ MAC as requested). The system was designed to use Class C telephone lines and standard PBX switching available at the prototype sites.

Table 1-1

ATCBT Prototype System Design

Component	Configuration
Delivery	AT&T 6300 Personal Computer o MS-DOS o Single floppy disk drive o 10 megabyte hard disk drive o 640K RAM o Keyboard o 320x200 resolution color graphics monitor o CDS II delivery software o Modem
Management	AT&T 6300 Personal Computer o MS-DOS o Single floppy disk drive o 10 megabyte hard disk drive o 640K RAM o Keyboard o 320x200 resolution color graphics monitor o CDS II delivery software o dBase II software o Communications software o CONTROL software o Draft quality printer o Modem
Production	AT&T 6300 Personal Computer o MS-DOS o Dual floppy disk drives o 640K RAM o Keyboard o 320x200 resolution color graphics monitor o PC Paint software and Mouse System mouse input device o CDS II authoring software

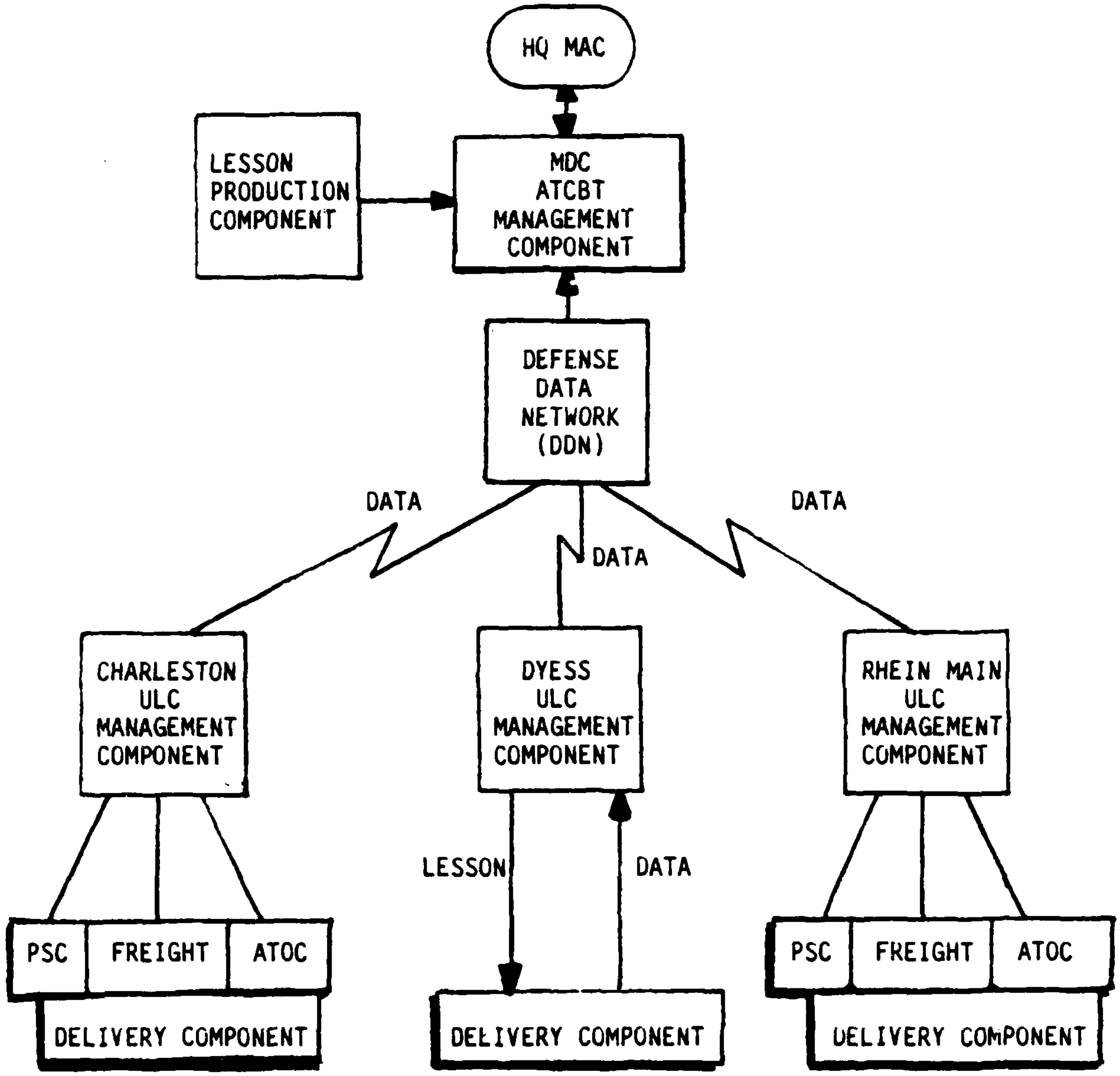


Figure 1-1. ATCBT System Design

As a trainee completes a lesson at the work station, the data is recorded and automatically sent to the ULC. The recording and reporting of such information is not visible to the trainee. The data is consolidated at the ULC as a master file. Then, the ULC monitor, using a menu of report options, generates reports for the various levels of management, including the OJT supervisor. The ULC monitor also has the data management capability to add files, edit files, and purge files as required. After data has been consolidated and reported at the local level, it is periodically sent, via electronic mail on DDN, to the MDC. The MDC then uses this management data to determine the requirements for new lessons and revisions to existing lessons.

As shown in Figure 1-1, there is also a downward transmission of information from the ULC to the work stations. This is in the form of lesson down-loading. A unique feature of the ATCBT is the capability to search throughout the system for a lesson which has been requested by a trainee. For example, if a trainee requests a specific lesson which is not stored at that station, the system will find where the lesson is stored (perhaps at the ULC master file of lessons) and offer the trainee the option of down-loading that lesson for use. In addition, this same capability allows the ULC monitor to send lessons to every delivery station to update lessons or add new lessons to the files.

1.3 Task and Media Analysis

A task analysis was performed to identify training requirements and to select tasks for training for both the prototype evaluation and command-wide implementation. A media analysis was performed to identify the media attributes required to meet the instructional characteristics and to define the mix of media to accomplish the training requirements.

In order for the ATCBT system to be accepted and useful at the aerial ports, it must specifically meet AFSC 605XX training requirements. These training requirements are published in the Specialty Training Standards (STSs) that designate tasks which must be trained in order to progress in the career field. As outlined in the STSs for AFSC 605XX, the primary focus of OJT is to take the basic Air Transportation Training Command (ATTC) graduate entering the squadron at a 3-skill level to a 5-skill level. The introduction of delivery stations at the work centers provides OJT supervisors with a resource to accomplish this training. The CBT lessons used in combination with hands-on training minimize the time required by the OJT supervisor to ensure proficiency requirements are satisfied. Although the primary intent of ATCBT instruction is to provide 3- to 5-skill level training, it can also be used to provide proficiency training, recurring training, refresher training for other levels, and cross-training at the 7-skill level (Air Transportation Supervisor--AFSC 60572).

Review of STS 605X1 for the Air Cargo Specialist and STS 605X0 for the Air Passenger Specialist resulted in a preliminary estimate of 142 hours of instruction that could be implemented on CBT. This estimate was revised and refined during the prototype evaluation. The revised estimate is included in Section 3.4.3 of this report.

The training requirements identified in the STSs were analyzed in order to specify the critical media attributes and the mix of media necessary to accomplish OJT. The results of the media analysis indicated that medium resolution color graphics and keyboard input were sufficient to meet the training requirements. Computer controlled audio and/or video and student input devices such as a mouse, light pen, or touch panel exceeded the requirements to provide adequate training. The media mix to satisfy OJT proficiency levels was defined as the ATCBT lessons in combination with adjunct materials (in the form of reference manuals, technical documentation, illustrations, handouts) and actual hands-on performance.

1.4 Production Component Implementation

Implementation of the production component consisted of a number of subtasks. These included:

1. Development of the authoring environment for the MDC to use.

2. Development of the prototype ATCBT lessons.

3. Validation of the prototype lessons.

4. Installation of three ATCBT systems at Travis AFB.

5. Training the MDC staff in analysis, design, and authoring procedures and in the use of the data management functions.

The first three subtasks are described in detail in the following subsections. Training the MDC staff was an ongoing activity. ISD, Inc. personnel worked closely with the MDC personnel at all stages of the production component implementation. The MDC inputs were essential in the development of a useful authoring environment. Their expertise and review comments were also necessary in the development and validation of the prototype lessons.

ISD, Inc. personnel conducted a number of hands-on training sessions on-site and at the MDC after the ATCBT systems were installed in June 1985. These sessions included: development of lesson specifications, procedures for authoring, procedures for editing, development of graphics, use of DDN, generation of management reports, procedures for downloading data. A User Guide documenting these procedures was also provided.

1.4.1 Development of the Authoring Environment

As stated earlier, one of the most important criteria in designing the ATCBT system was the development of an authoring capability for non-programmers. It was essential that no computer programming skills be required for MDC personnel to author a lesson. In addition, the lessons needed to be based on a standardized, structured, sequence of instructional events, as opposed to a "free-form" set of text screens. The solution was to provide an authoring "environment" in which the author would operate. This environment would (1) prompt an author for a specific entry (such as a learning objective, test item, or correct answer) in a specific sequence, (2) take the author's response to the prompt, and (3) automatically generate computer "code" that is executed when the student runs the lesson.

The ability of CDS II to construct an authoring "meta" language was used to design the authoring sequence of prompts that would generate a lesson. The author only inputs text and graphic file names in response to the authoring prompts. The format, sequencing, and branching capabilities of a lesson are already set and are produced without any additional input by the author. An author only needs to respond to prearranged prompts in order to construct a lesson.

The structure of the lesson, including the prearranged prompts, is called the "prototype," "lesson prototype," or "authoring prototype." The prototype is based on a strategy or "paradigm" for presenting effective instruction via computers. The instructional paradigm for producing the standardized ATCBT lessons defined a set of instructional units. These units were divided into two levels: the lesson level based on the terminal learning objective and the segment level based on the enabling learning objectives. Each segment includes discrete chunks of instruction (introduction, explanation, practice, and test) related to one lesson enabling objective. A lesson, by definition, contains more than one segment.

The authoring prototype was developed to not only reflect this governing instructional paradigm, but also to include an instructional design that was sensitive to the delivery environment. For example, segments can be accessed individually by a student, and a student can escape at any point in the lesson in the event more pressing events occur at the work station. The student can then come back and continue with the same segment. The capability to access the segments individually also maximizes the usefulness of the lesson exam. Students receive a prescription of what segments need to be taken based on their performance on the lesson exam. The required segments can then be taken rather than the entire lesson. This feature fits the design concept of adequate training, since students can view only those portions of the lesson that are required.

Several basic conventions, based on instructional design principles, were established for the units in the ATCBT authoring prototype. The authoring conventions include:

- Learning objectives that include conditions, behavior, and standards.
- Inclusion of lesson prerequisites, required materials, and related STS items at the start of the program.
- A student option to take the lesson exam as a pretest or go to specific learning segments at the start of a lesson.
- A lesson exam that incorporates items based on all lesson segments.
- Lesson exam feedback that displays which items were missed and tags individual test items to their related segments.
- Lesson segments based on identified enabling learning objectives.
- Practice exercises that are consistent with the behavior and conditions specified by the enabling objectives.

- Practice items that allow the student to make three attempts for the correct response before advancing to the next item.

- Segment tests that are matched to the enabling objective. Thus, the same test item format as that for the practice items is anticipated.

- Feedback as to which items are missed during the segment test.

- Successful completion of the lesson exam is used to indicate mastery of the lesson (terminal learning objective).

The instructional units were initially designed by ISD, Inc. and reviewed by the MDC staff throughout the prototype development cycle. The MDC staff was involved in the design of authoring interfaces, including the wording and appropriateness of explanations and prompts within the prototype. Their input contributed, for example, to the inclusion of established exits at various points in the authoring process and to the segment practice, testing, and feedback structure.

1.4.2 Development of Prototype Lessons

The contract Statement of Work specified that eight hours of CBT instruction be developed in general topic areas for the prototype evaluation. The topic areas for these lessons were further defined during the review of the STS items. A learning analysis was performed for each topic to determine the entry level characteristics, identify prerequisite skills and knowledge, and specify the lesson content. As a result, nine prototype lessons were specified--three for Air Passenger Specialists and six for Air Cargo Specialists. A format for presenting the lesson specifications was developed to serve as guidelines to be used during the CBT authoring process.

The MDC personnel participated in task selection for training and in the construction of lesson specifications. The purpose of their involvement was not only to utilize their expertise, but to demonstrate the process to specify learning objectives, evaluation strategies, and presentation strategies for potential CBT lessons. The goal of the exercise was to emphasize the difference between CBT lesson development and the more-familiar sound-slide production, in which scripts and storyboards are created in response to an assigned topic, with little consideration for testing/evaluation strategies and no concern for display-response interactions.

The content of the lessons was based on five sources: draft technical manuals, operational orders, Air Force regulations, CDCs, and subject matter specialists. All lessons were reviewed at various stages by subject matter specialists from HQ MAC and the MDC. The lessons were reviewed for appropriate use of terminology, accuracy of content and practice/test items, and completeness of information. Accompanying graphics were developed to illustrate points of instruction (e.g., hand signals, aircraft safety zones, equipment).

1.4.3 Prototype Lesson Validation

Three stages of lesson validation occurred during the prototype evaluation: MDC review, small group validation by a sample of the target population, and field implementation. The MDC staff reviewed the lesson

specifications, lesson content, and test items for technical correctness. Corrections were incorporated for the small group validation by personnel from the target poulation located in the aerial port squadron at Travis AFB.

Validation focused on the lessons "teachability" as opposed to lesson content. A lesson could be technically correct, but still not teach. Ten to 12 students were assigned to take three lessons each. At least one contractor-assigned proctor was present to observe and answer questions. Any questions, comments, and inconsistencies were noted as students progressed through each lesson segment. These notes became one source of revision. A typical example was a student attempting to input an apparently correct answer, but having the answer treated by the software as incorrect. This answer was not considered as a possible correct answer during initial lesson development so it needed to be included as a potential correct answer during revision.

Test data for each lesson was also collected in the background as students took the lessons. The data included the number of correct and incorrect responses per test item and, if the response was incorrect, the actual response was recorded. This data pointed to questions that were either misleading or not well covered by the information presented in the lesson. Lesson revisions were made on the basis of observed problems/inconsistencies and the test item analysis.

Validation continued after the lessons were implemented at the prototype evaluation sites. Again two sources of information were available for lesson revision: comments from students taking the lesson and test item data. Revision comments from the field were received by the MDC staff and forwarded to ISD, Inc. If the comment required immediate action (e.g., a possible correct answer not treated as correct), the correction was made and updates were sent on floppy disks to the prototype evaluation sites. Comments not requiring immediate action were noted as a lesson maintenance requirement to be performed during command-wide implementation. Test item data was also collected and analyzed during the evaluation. Again, any indications that a potential problem existed were noted as a lesson maintenance requirement to be completed after the prototype evaluation.

1.5 Prototype Site Implementation

Three aerial ports with differing missions were specified as prototype implementation sites to test the ATCBT concept of operation. Charleston AFB, South Carolina represents a major strategic port responsible for moving a large number of passengers and cargo in support of the MAC mission. Dyess AFB, Texas represents a mobile aerial port that provides a training environment unique to mobility planning and operations. Rhein Main AB, Germany represents a major strategic port operating in a non-CONUS environment.

Implementation planning prior to actual installation at each aerial port included a number of activities. As part of the planning process, a survey was sent to the three prototype sites and to the command-wide implementation sites to gather data on the following:

1. Personnel/Work Force Description (numbers and types).

2. Personnel Scheduling (work station shifts and OJT schedule).

3. Work Station Layouts (locations and distances between work stations).

4. OJT Training (STS tasks and other tasks requiring training).

This data was used, in part, to identify the number of systems needed at each prototype site. ISD, Inc. developed a set of assumptions based on the mix of aerial port personnel working in cargo and in passenger services, the number of personnel by shift, the number of student contact hours, and the number of hours of training system availability to determine the number of systems. Table 1-2 summarzies the configuration installed at each prototype site. It should be noted that the management component at each ULC also serves as a delivery station for students and that the management component at the MDC provides the authoring capability of a production component.

Table 1-2

Prototype Implementation Sites

Prototype Site	Total Number	Location	Number and Type of Component
Travis AFB	3	MDC	1--Management
		MDC	2--Production
Charleston AFB	4	ULC	1--Management
		Passenger Service	1--Delivery
		Freight	1--Delivery
		ATOC	1--Delivery
Dyess AFB	2	ULC	1--Management
		ULC	1--Delivery
Rhein Main AB	4	ULC	1--Management
		Passenger Service	1--Delivery
		Freight	1--Delivery
		ATOC	1--Delivery

An ATCBT Implementation Plan was developed to define: (1) ATCBT training organization, roles and responsibilities, (2) training and job aids for ATCBT users, (3) facility preparation requirements, including environmental considerations, power requirements, base communications requirements, (4) maintenance support requirements, including preventive and corrective maintenance procedures, and (5) the plan for prototype system validation. In addition, ISD, Inc. prepared a User's Guide for Prototype Evaluation and Validation for use by the ULC monitor. It provided detailed procedures for

operation and maintenance of the ATCBT system, as well as the validation requirements and procedures.

The ATCBT systems were installed at the prototype sites between June and August 1985. This schedule allowed up to 26 weeks for the evaluation period. ISD, Inc. personnel, in conjunction with personnel from HQ MAC and the MDC, spent a minimum of one week per site for ATCBT system implementation. Activities included:

1. Physical installation of the hardware and software.

2. System testing.

3. Training the ULC monitor and designated personnel on procedures for taking lessons, generating reports, training data management, preventive and corrective maintenance, and validation data collection.

4. Briefing aerial port squadron supervisors on the availability of the training system at their work stations.

1.6 Prototype System Evaluation

The last task was to validate and evaluate the prototype system at the three aerial ports and the MDC. The purpose of the evaluation was to determine the effectiveness of the prototype ATCBT system in providing initial, recurring, and upgrade training for MAC aerial port personnel. The evaluation was not designed to measure the effectiveness of CBT as a medium versus other media. It was designed to evaluate the effectiveness of integrating CBT into the OJT environment. The objectives were to evaluate:

1. The effectiveness of using CBT to deliver OJT instruction at local work stations.

2. The reliability and maintainability of the CBT system components.

3. The effectiveness of a centralized CBT lesson production component.

4. The ease of use of the ATCBT authoring environment by non-programmers.

5. The effectiveness of the management component in collecting data in the background.

6. The effectiveness of collecting, consolidating, and disseminating training management information--including the quality, frequency, and usefulness of the reports.

7. The capability of the prototype ATCBT system to minimize supervisor training time and not require additional manpower or skills training.

Evaluation of the prototype delivery and management components required inputs on use and acceptance by the trainees, the ULC monitors, and the work station supervisors. Four data collection tools were provided: (1) automatic data collection provided as part of the prototype CBT lessons, (2)

questionnaires administered to trainees after completion of individual lessons, (3) surveys administered periodically to OJT supervisors, and (4) system use logs. Evaluation of the production component included interviews with MDC personnel and an ATCBT authoring system log maintained throughout the evaluation period. The results of the evaluation are detailed in Section 2.0.

SECTION 2.0

PROTOTYPE EVALUATION
RESULTS AND RECOMMENDATIONS

In order to present the results and recommendations of the prototype evaluation in a concise, meaningful way, this section is organized by the three components of the ATCBT system: delivery, management, and production. Each of the subsections provides a description of the specific objectives under evaluation for that component. Although some of the objectives cut across components (i.e., system reliability and maintainability), they are discussed under the component deemed most appropriate. To facilitate the presentation of specific evaluation results, the standardized format shown below was used in each subsection:

- ISSUE: Used to break down the specific evaluation objectives into issues of concern.

- RESULTS: Used to document activities performed, data collected, problems encountered, lessons learned, etc.

- CONCLUSIONS/RECOMMENDATIONS: Used to state conclusions that can be drawn from the results and to provide recommendations for command-wide implementation.

2.1 Delivery Component

A primary purpose of the prototype system evaluation was to determine the effectiveness of the ATCBT system in delivering training to the local work stations. The prototype system was designed to provide a training environment which (1) minimizes time away from the job, (2) makes training easily accessible to the person to be trained, and (3) presents interactive, self-paced, performance-based instruction. Information on the effectiveness of using CBT to deliver OJT instruction at the local workstations was collected from the users in the aerial ports. There are three primary users:

1. The trainees who are trying to increase their proficiencies in relevant STS/JQS items.

2. The OJT/section supervisors who are responsible for identifying the OJT requirements of personnel and setting proficiency requirements.

3. The ULC monitors who are responsible for supporting the OJT training media in the field.

The specific objectives for evaluating the prototype delivery component were defined as follows:

1. Was the CBT instruction effective? Did the CBT lessons provide job-relevant training?

2. Did the CBT lessons show the potential for minimizing supervisor time required to train personnel?

3. How were the CBT lessons utilized? Which lessons were completed? How much time was taken?

4. How were the CBT delivery stations utilized? Were they accessible? Were they used during the shift?

5. Were the ATCBT support requirements sufficient?

6. Was the prototype system configuration adequate?

The results of the evaluation are organized into five categories in the following subsections: (1) Training Effectiveness, (2) CBT Lesson Utilization, (3) CBT Station Utilization, (4) CBT Delivery Support Requirements, and (5) Prototype Delivery Media Configuration.

The sources of data used for the evaluation were:

1. Lesson Performance Data. This data was collected at all three sites while the lessons were being taken. Each site converted the data to a format compatible with DDN mail transmission and sent it to the account set up for this purpose. Hardware, software, and procedural problems which occurred primarily at the onset of the test period account for some missing data. Data was collected at all sites primarily between October 1985 and February 1986 after most problems were corrected. ISD, Inc. received raw data from 447 lesson executions of all nine lessons. About 40% of the lesson data was generated by AFSC 60530 students; the remainder was from 60531 students. This data does not include all people who took lessons.

2. Lesson Report Surveys. The lesson report questionnaire was designed to collect written feedback from the target population of trainees; those in transition from the 3- to 5-skill level. This information describes reactions to the materials, system, and learning environment. The evaluation design called for each person taking a lesson to fill out a questionnaire following lesson completion. The questionnaires were left at the stations and completed on a volunteer basis. The evaluation period ran from July 1985 to February 1986. Lesson reports were sent to ISD, Inc. by ULC monitors with dates ranging from August 1985 to early January 1986. A total of 203 lesson report surveys were included in the analysis. The data from the lesson reports is summarized in Table 2-1.

3. ULC Monitor Surveys. At the conclusion of the evaluation period, a debrief, using a structured questionnaire, was held with each ULC monitor by the ISD, Inc. project manager. The questions covered (1) effectiveness of CBT, (2) data management usefulness and further needs, (3) maintenance, (4) training, (5) job aids needed, and (6) training support personnel. Many of the comments related to the delivery component, especially in the first category--CBT effectiveness.

4. System Logs. ISD, Inc. kept a log of system hardware and software problems reported by the ULC monitors. This information provides a picture of what might be expected in the future.

Table 2-1

Lesson Report Item Analysis

NOTE: Trainee percentages are based on the number of responses per location. The combined score represents percentages based on the total number of trainee responses. Supervisor responses were conributed from Charleston AFB only.

1. Were there any problems during the lesson (such as interruptions, system problems, procedures not understood, etc.)?

Trainees	Yes	No	No Response
Charleston	6%	94%	0%
Dyess	11%	89%	0%
Combined	9%	91%	0%
Supervisors	19%	80%	0%

2. Were you able to use the system when you wanted to, or did you have to wait to come back?

Trainees	Use Immediately	Wait	No Response
Charleston	82%	18%	0%
Dyess	91%	9%	0%
Combined	87%	13%	0%
Supervisors	90%	10%	0%

3. How much time did you have to take the lesson?

Trainees	Average Time (Measured)	Adequate/Unlimited Time	No Response
Charleston	50% - 2.8 hours	47%	3%
Dyess	28% - 2.0 hours	72%	0%
Combined	39% - 2.4 hours	60%	1%
Supervisors	32% - 1.8 hours	68%	0%

4. Was time taken during your shift of duty?

Trainees	Yes	No	No Response
Charleston	90%	10%	0%
Dyess	56%	44%	0%
Combined	73%	27%	0%
Supervisors	96%	4%	0%

5. Are there other lessons in this area that you would like to see?

Trainees	Response	No Response
Charleston	29%	71%
Dyess	3%	97%
Combined	16%	84%
Supervisors	46%	54%

Table 2-1 (Continued)

6. Did you take this lesson to advance in your career?

Trainees	Yes	No	No Response
Charleston	67%	30%	3%
Dyess	66%	34%	0%
Combined	66%	32%	2%
Supervisors	68%	31%	1%

7. Did your supervisor assign the lesson or did you decide to take it yourself?

Trainees	Supervisor-Assigned	Self-Motivated	No Response
Charleston	38%	57%	5%
Dyess	66%	34%	0%
Combined	52%	46%	2%
Supervisors	22%	76%	2%

8. Do you think that the lesson material is relevant to your career advancement?

Trainees	Yes	No	No Response
Charleston	85%	9%	6%
Dyess	86%	14%	0%
Combined	86%	12%	3%
Supervisors	85%	12%	3%

9. Do you like this way of training?

Trainees	Yes	No	No Response
Charleston	94%	3%	3%
Dyess	75%	25%	0%
Combined	85%	14%	1%
Supervisors	91%	6%	3%

10. Do you have any suggestions for making this lesson better (such as questions asked during the lsson or the way it is presented or tested)?

Trainees	Yes	No	No Response
Charleston	16%	74%	10%
Dyess	6%	89%	5%
Combined	11%	82%	7%
Supervisors	21%	74%	5%

2.1.1 Training Effectiveness

ATCBT training effectiveness was measured by (1) whether or not people learn, (2) how job related the learning is, (3) interest in having other lesson topics on CBT (as a sign of acceptance), and (4) the potential of CBT to minimize time required of supervisors for training 605XX AFSC personnel.

ISSUE:

The most important question for a training system is, "Does the intended target population learn from the lessons?" Were the aerial port personnel able to learn effectively with ATCBT?

RESULTS:

o Mastery of Lesson Material

To determine how effective the training was for learning, the segment test items were analyzed across lessons in the AFSC. The percent of correct (indicating mastery) versus incorrect (non-mastery) test items was determined. The "percent of lesson mastery" was computed by dividing the total number of correct responses by the total number of responses. Table 2-2 shows the results by the lessons pertinent to each AFSC and then by each of the three sites. An overall percent, by lessons in the AFSC, is also shown for comparison.

Table 2-2

Group Levels of Competency

AFSC	Lessons Available	Percent of Mastery per Lessons	Average Number of Related STS Items
60530	3		
Charleston		84%	3.00
Dyess		62%	6.85
Rhein Main		90%	6.25
Overall		84%	5.28
60531	6		
Charleston		80%	3.67
Dyess		82%	7.53
Rhein Main		81%	4.00
Overall		81%	5.02

For the three 60530 lessons, the average mastery was 84%. A percent of 68% or greater should be expected for valid items. It should be noted that Dyess AFB results show only 62%. However, this figure is acceptable because there are no AFSC 60530 personnel at the 1st MAPS at Dyess AFB to take these lessons. The lessons were taken by AFSC 60531 personnel who are not familiar with either the manual or automated passenger check-in system. They should reach mastery with additional practice on the lessons.

The six lessons related to 60531 STS items also show an overall percent mastery of slightly better than 80%. In all cases, complete mastery should be reached by re-taking those parts of the lesson not satisfied.

- Job Relatedness

Table 2-2 also shows the average number of STS-related knowledges which those people in the data sample satisfied by mastery of items tested. Each learning objective in a lesson was specifically related to STS items during the design of the lesson. While mastery of the CBT lesson material does not, in most cases, provide full proficiency on STS items, it does provide knowledge and skills leading to the full STS proficiency required. Full STS/JQS proficiency usually requires more hands-on training than CBT allows.

Another indication of job relatedness can be drawn from the users. As shown in Table 2-1, the lesson reports indicated that the majority of trainees (86%), as well as supervisors (85%), felt that the lesson material was relevant to career advancement within the AFSCs. ULC monitors, in the final debrief, also agreed that the ATCBT lessons were highly job relevant; much more so than the slide/tape programs.

- Acceptance of ATCBT

Eighty-five percent of the trainees indicated that they liked the method of training. Nineteen percent more Charleston trainees than Dyess trainees responded positively. Ninety-one percent of the supervisors favored the use of CBT for instruction.

Another indication of acceptance are the comments from lesson reports on other areas of instruction the participants would like covered by CBT. Topics named as desirable for CBT training included Form 109's, all cargo handling, MAC regulations, PSC, PAX dispatch, ramp service, tie down, vehicle operations, lost and found and many broad topics in both AFSCs. Similarly, supervisors suggested about 30 broad topic areas including statements about covering 5-skill level topics, "all ISDs," mobility, phase II, and other advanced training.

CONCLUSIONS/RECOMMENDAIONS:

Both the performance data and perception of trainees and supervisors indicated that (1) learning occurred, and (2) the learning was job related (tied to STS/JQS items) and relevant to career advancement, and (3) CBT, as a method of training, was highly acceptable.

There are no direct data available with regard to how ATCBT might affect supervisor time for training personnel. Since the system is training effective and does not require supervisors to be present during the taking of a lesson, it should be assumed that ATCBT will not add to time required. In fact, it is likely to decrease supervisor time for training if enough lessons are available to support STS/JQS proficiency attainment. The need expanding the lesson inventory has already been considered in planning for command-wide implementation. Section 3.4.3 presents the CBT lesson development list prioritized by need in the field.

2.1.2 Lesson Utilization

Management data reports, as well as subjective feedback, were reviewed to determine (1) how lessons were utilized and (2) what motivated people to take them. Lessons were designed to meet the requirement for a learning segment that was short enough to be completed between work tasks and other interruptions. A primary objective was to facilitate training at the work site which would not conflict with the normal flow of duties. Users could exit programs after completing a lesson segment and return at a later time to complete other segments.

2.1.2.1 Use of Lesson Exam Pretests

ISSUE:

Did students use the lesson exams as pretests?

RESULTS:

The student responses from 287 lessons are summarized below.

	Pretests Used	Pretests Not Used
Charleston	57%	43%
Dyess	51%	49%
Rhein Main	49%	51%

Students were encouraged to take lesson exams prior to going through the instruction. This pre-test capability allowed the trainees to concentrate on their deficient areas without wasting time on previously mastered materials.

Approximately half of the students appeared to use the pretesting capability built in through the lesson exams. Data is insufficient to form precise correlations between pretesting and lesson segment selection, but some evidence of self-prescription is shown by the results in Figure 2-1.

CONCLUSIONS/RECOMMENDATIONS:

Lesson exams were used as pretesters by some students. Clear instructions for using this capability must be provided to all students at the onset of computer-based training.

2.1.2.2 Use of Pretesting to Select Relevant Training

ISSUE:

Was differential use of segments demontrated?

RESULTS:

The graphs in Figure 2-1 demonstrate that a significant number of trainees elected to pre-test to determine their knowledge of lesson segment contents. Low numbers of users on individual segments are one indication that people tested out before taking the lesson. High numbers of users indicated greater participation in lesson review, which may be accounted for in segments that contained unfamiliar materials. Blank areas appear on the graphics for those lessons containing less than eight segments; they do not imply missing data.

Furthermore, system data analysis revealed that not all segments were taken in order. The implication is that some discriminations were made based on utilization of pretesting capabilities.

CONCLUSIONS/RECOMMENDATIONS:

The pretest capabilities were used by trainees as intended to afford flexibility and efficiency in segment selection. Training time was spent effectively since effort was not spent going over materials already mastered by the users.

2.1.2.3 Ratio of Initiation to Completion of Lessons

ISSUE:

How many learners completed lessons once they initiated them?

RESULTS:

Table 2-3 illustrates the number of lessons initiated by users and the completion results. The initiated lessons are determined by the total sign-ons to a lesson regardless of the intent of the user. Incidental sign-ons were logged onto the system during personnel training sessions for operation of the system. These are indistinguishable from actual lesson user sign-ons and are, therefore, not excluded from the totals.

Figure 2-1. Segment Selection Graph

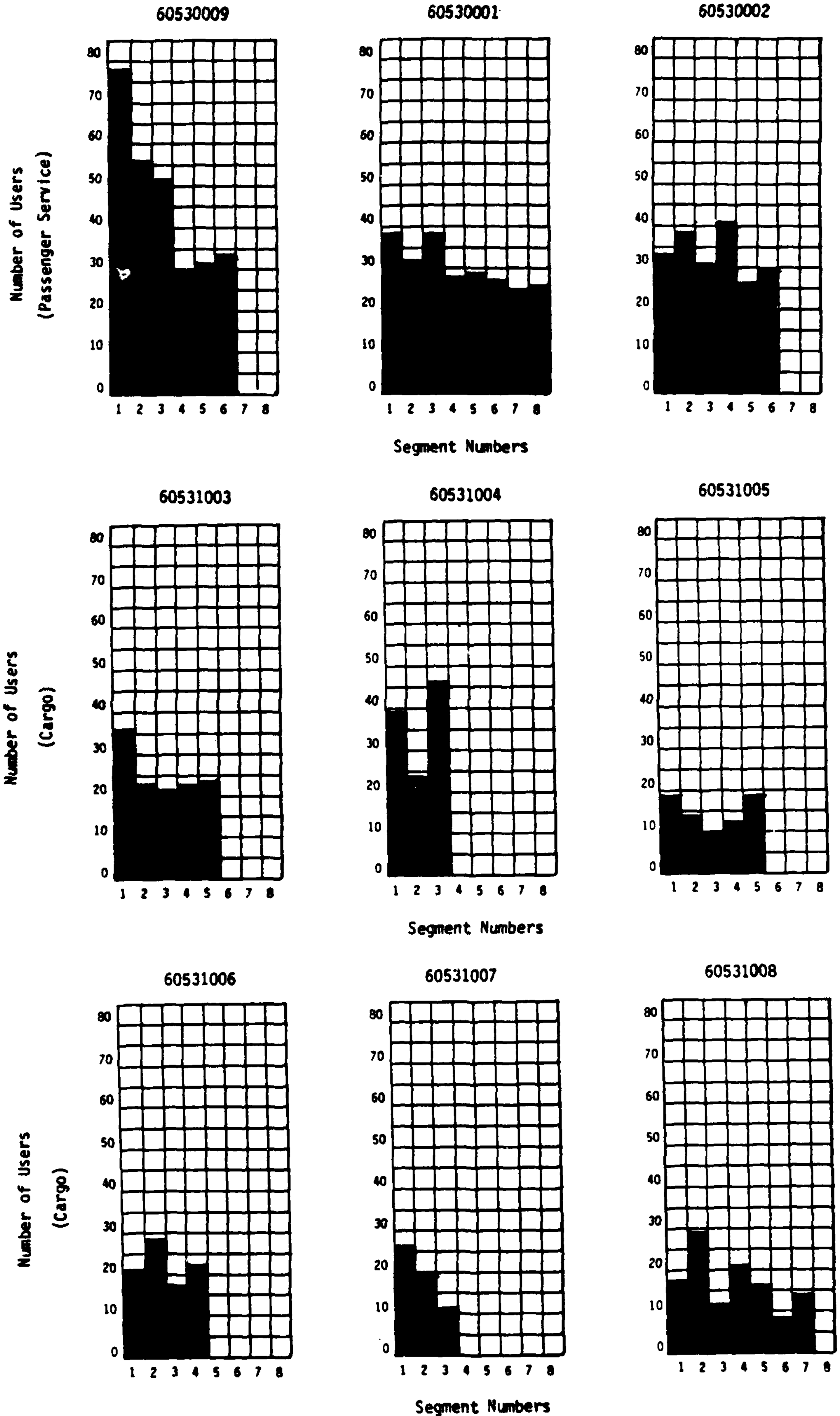


Table 2-3

Lessons Initiated vs. Completed

AFSC	Total Lessons Initiated	Percent Completed	Passenger 60530	Cargo 60531	Avg. Completions Per Trainee
Charleston	207	25	1.20	1.37	1.33
Dyess	108	77	2.20	3.26	3.08
Rhein Main	137	74	3.33	2.18	2.36

CONCLUSIONS/RECOMMENDATIONS:

The low percent of completion at Charleston reflected a large number of personnel completing individual lesson segments but not completing the lesson exam. At present, lesson completion is determined by satisfactory completion of the lesson exam. Tracking individual lesson segments should be incorporated into the system for command-wide implementation. This will ensure trainees receive credit for completion of the lesson if they satisfy the segment requirements defined by the pretest results.

2.1.2.4 Incentive for Training on CBT

ISSUE:

What was the reason for lessons being taken?

RESULTS:

A modest majority of trainees (67%) indicated that they had taken the lessons to advance their careers. It is somewhat surprising that almost an equal number of supervisors (68%) made the same response. This may indicate the need for refresher and/or cross-training for supervisors.

Fifty-seven percent of the Charleston trainees elected to take the lessons, compared to only 34% of the Dyess trainees. The motivating factor at Dyess appear to have been supervisor assignment, which accounted for 66% of the student participation. The majority (76%) of supervisors taking lessons elected to do so, although almost a quarter (22%) were assigned to the lessons by their supervisors.

CONCLUSIONS/RECOMMENDATIONS:

Most participants took the lessons to advance their careers, and were self-motivated to take them.

2.1.3 CBT Station Utilization

ISSUE:

A critical issue is how the work stations were utilized. Utilization is examined here in terms of system accessibility, use of shift time, time allotment versus actual system use, and impact of problems.

RESULTS:

- Accessibility

  Work stations were physically accessible to most of the target population because they were set up directly at or nearby the actual job performance sites. Users did not have to travel or suffer major interruptions to their normal work day routines in order to take the lessons. There were a number of potential users at Charleston International Airport and at Rhein Main who were physically too far removed from workstations to participate in lesson testing. Eighty-seven percent of the trainees and 90% of the supervisors stated that the system was available for use when needed. Charleston users had slightly more delay time than Dyess users.

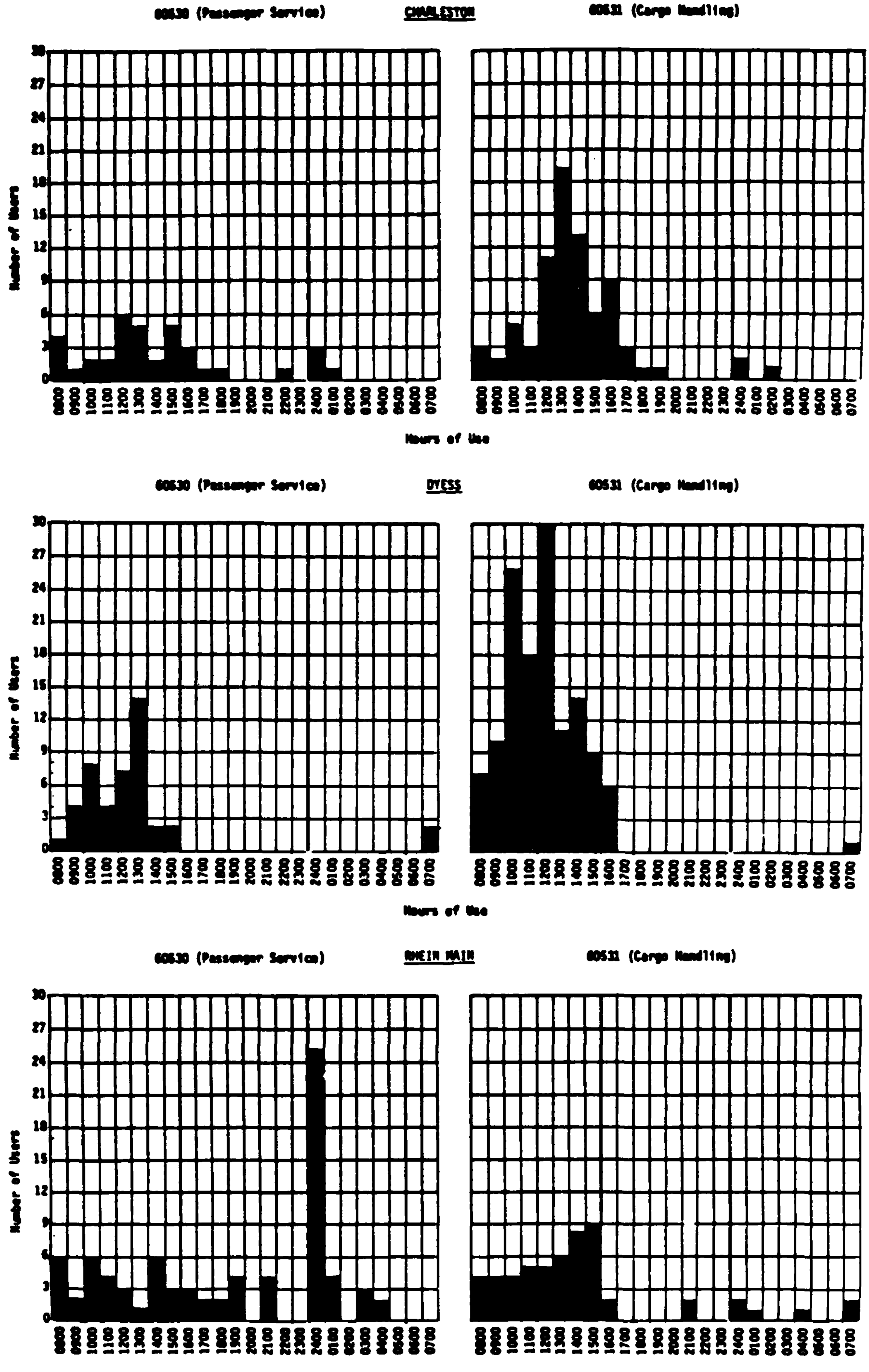
- Use of Shift Time

  Ninety percent of the Charleston trainees used shift time to take lessons. The somewhat limited hours (0800-1700) of system availability at Dyess may account for only 56% shift time use by the trainees. Ninety-six percent of the supervisors took lessons during shift time.

  As shown in Figure 2-2, system use varied with the type of lessons being taken as well as the hour of day. Passenger service lesson use was heaviest between 0800 and 1800 at Dyess and Charleston, but at Rhein Main, it was much more pronounced between 2400 and 0100. Cargo handling lessons were most often taken between 0800 and 1700. These use patterns seem to correlate with the known work patterns of the two groups of participants. That is to say, the heaviest lesson use corresponds with the lightest workload times.

  The frequency graph numbers are based on actual lesson executions (N = 316). Invalid frequency data, such as repeated re-booting without date and time, was distinguished from real data by a default-assigned date of January 1980. The latter did not allow assignment to real times or shifts and were not used.

Figure 2-2. System Use Frequency Graph



- Time Allotment versus Actual System Use

  The majority of trainees (60%) stated that they were given adequate or unlimited time to take lessons. Those who were given blocks of measured time (39%) averaged 2.2 hours on the system. Sixty-eight percent of the supervisors had adequate or unlimited time to take lessons, and 32% of them demonstrated an average of 1.8 hours of measured time. Actual system use showed that the average viewing time per lessons was 60 minutes for the 60530 (passenger) lessons, and 35 minutes for the 60531 (cargo) lessons. The overall average viewing time for combined lessons was 42 minutes.

- Impact of In-Use Problems

  The majority of trainees (92%), as well as supervisors (81%), did not experience problems while running the lessons. Among those who did have difficulties, trainees noted system problems, while supervisors noted interruptions by others as the primary sources of disruption. The system problems noted by the trainees were corrected early in the evaluation to avoid confounding the validation process.

CONCLUSIONS/RECOMMENDATIONS:

User accessibility is good among the currently installed systems, and only a minimum number of problems were experienced during lesson execution. This results in user perceptions of effective training. There is a need to identify pockets of learners in remote areas to enhance accessibility as more systems are installed in the future.

Most users were given adequate time during their work shifts to complete lessons. Although the lessons are designed in segments which can be completed in 10 to 15 minutes to allow for workshift interruptions, it appears that most users were given sufficient time to complete entire lessons (one hour) during slack periods.

A calendar clock should be installed in the computer hardware to assist in accurate data entry compilation.

2.1.4 CBT Delivery Support Requirements

Interviews with the ULC monitors and OJT supervisors, and comments from students, all pointed to the need for more explicit information at the CBT stations. This information inclues (1) CBT student job aids, (2) adjunct training materials, and (3) supervisor job aids.

2.1.4.1 Terminal Operation Job Aids

ISSUE:

How much does a student need to know in order to use the CBT equipment?

RESULTS:

The ATCBT system was designed to make interaction extremely easy. However, there were still instances in which students were not aware of the

operating conventions. For example, (1) some could not log onto a lesson (i.e., type in six digit student I.D.), (2) did not know to press "RETURN" when entering a selection from a menu, (3) did not know to use the backspace to correct wrong entries, and (4) did not know about the "ESC" (escape) key to exit from a lesson immediately if necessary. Comments from students and supervisors alike requested specific aids on basic operation, despite the presence of typed instruction sheets in notebooks at most of the prototype sites.

CONCLUSIONS/RECOMMENDATIONS:

The students would benefit from simplified, but specific operating information (e.g., student I.D.s) and keyboard instructions posted in a prominent area (perhaps even stickers on the machine). This would reduce delay time in the student deciding what to do, decrease inaccurate entries, and minimize student frustration.

2.1.4.2 Adjunct Materials

ISSUE:

Were the required adjunct training materials used during the lessons?

RESULTS:

There were four prototype lessons that required the use of adjunct materials. The materials included handouts for the three PACS lessons and AFR 71-4 for the Hazardous Materials lesson. Evidently, none of these materials were made available at the work stations. Lack of the PACS handouts probably accounts for most of the incorrect responses noted in examining the test item data.

CONCLUSIONS/RECOMMENDATIONS:

If a CBT lesson is built around the use of adjunct training materials, then those materials need to be available at the delivery station. This can be accomplished by making the statement about required materials that occurs within the lesson more specific and/or stronly worded and by developing a list of required materials so the ULC can establish a "library" of materials. Responsibility should lie with the OJT supervisor, but assistance should be given as needed.

2.1.4.3 Supervisor Job Aids

ISSUE:

What tools and resources does the OJT supervisor need in order to facilitate his training responsibilities and increase the effectiveness of CBT?

RESULTS:

Many supervisors expressed a need to be more familiar with the content of the CBT lessons. Lesson specifications were included in the ATCBT User Guide to outline the learning objectives, content, and evaluation strategies for each prototype lesson. Evidently, these were either not available or not used by

the supervisors. A catalog of CBT lessons is suggested. This might already be available in the form of the Transportation Training Catalog described in Section 2.3.4. However, the relation between the available lessons and OJT requirements is not described in the catalog. Supervisors need a tool to preview lessons before making assignments to students. As the number of lessons grows, the opportunity to take each lesson may not be possible.

CONCLUSIONS/RECOMMENDATIONS:

Supervisors need to have specific lesson summary information in order to help their decision making in utilizing CBT to supplement OJT. This summary should not be limited to CBT lesson titles, as currently included in the Training Program Catalog. Specific references to STS items need to be made in order to provide information to the OJT supervisor as to which CBT lessons relate to which JQS items. Thus, the supervisor can more effectively and efficiently assign CBT lessons to supplement OJT requirements.

2.1.5 Prototype Delivery Configuration

The prototype system design considered both the screen resolution and storage required to deliver instruction to the student effectively.

ISSUE:

Is the ATCBT system adequate, as configured, for delivering instruction?

RESULTS:

Based on student and supervisor comments at the prototype sites, the graphics presentation and resolution, as delivered in the lessons, was well received. There was a call for more illustrations and flow charts, but not for improvement in quality.

The current delivery station configuration consists of a 10 megabyte hard disk for lesson storage. The hard disk was originally included to preclude long delays in downloading lessons from the ULC to the delivery stations. However, this configuration was only tested for the initial nine lessons. The first lessons consumed 773K of memory, including all text files and picture files. Given an average of approximately 86K per lesson, only about 116 lessons would be able to fit on a 10 megabyte hard disk, excluding the run-time version of CDS and any locally generated student data. Since 60 lessons (over half of the disk capacity) will already be in the field by 1 October 1986, with a total of over 200 lessons by 1988, the need for expanded storage is apparent. A 21 megabyte disk could contain about 230 lessons with run-time software, which would be sufficient for the 200 lessons planned.

CONCLUSIONS/RECOMMENDATIONS:

The delivery station configuration should include a 21 megabyte hard disk. There is no requirement for faster processing or increased screen resolution during lesson delivery.

2.2 Management Component

The original concept of the management component, as defined by the contract Statement of Work, was that it consisted of information management. That is, the management component would provide consolidated and summarized training program information to personnel at the base level, as well as higher headquarters such as Numbered Air Forces and HQ MAC at Scott AFB. While this original management function remains, other management functions have been added to the concept of the ATCBT management component. These additions are a result of what was learned during planning, implementing, and evaluating the prototype. In order to organize the discussion to follow, a description of the complete management component is provided below.

To begin the description, it is relevant to make a general statement about what the word "management" has now come to mean within the context of the ATCBT system. ATCBT management means the methods by which the ATCBT organization plans, operates, and controls resources to meet its goals and objectives. By methods, we mean inputs, process, and outputs. It is the methods which are the primary focus of the prototype evaluation. Figure 2-3 represents the generic elements of the ATCBT management method.

```
INPUTS                                                OUTPUTS
REQUIRED  --------------->  PROCESS  --------------->  NEEDED
```

Figure 2-3. Model of ATCBT Management Methods

The ATCBT resources are not only (1) information, but (2) lessons, (3) computer hardware and software, (4) facilities such as communication lines and space for terminals, and (5) the people in the organization, including OJT/section supervisors and ULC monitors. Figure 2-4 represents the resources of ATCBT.

GOALS

Consolidate and Summarize
TRAINING INFORMATION
for Access by Managers

Provide Training, Job Aids, and
Workable Procedures to the
TRAINING ORGANIZATION

Update, Control, and Disseminate
LESSONS

Operate and Maintain
EQUIPMENT AND SOFTWARE

Prepare and Maintain
FACILITIES

Figure 2-4. Reaching Goals by Management of ATCBT Resources

The general ATCBT goals related to these resources are:

- o Provide the appropriate ATCBT training information to managers and users at the time it is needed. Key words here are "appropriate" and "time."
- o Ensure that all people in the organization know their responsibilities and have the training and support to accomplish their tasks.
- o Ensure that the CBT lesson inventory is current and readily accessible to aerial port personnel.
- o Ensure that all equipment and software is operational and maintained for maximum availability.
- o Ensure that facilities such as power, communications, and space are adequate for operations.

The remainder of this section is organized by the five categoriess of ATCBT resources: (1) Training Information Management, (2) Organization Management, (3) Lesson Management, (4) Equipment and Software Management, and (5) Facilities Management.

2.2.1 Training Information Management

The methods for management of ATCBT training information are depicted in Figure 2-5 below.

INPUTS -->	PROCESS -->	OUTPUTS
o Trainee register	o Input trainee and lesson data	o Printed reports
o Lesson catalog	o Collect performance data	o Queries
o Trainee performance data	o Generate summaries	

Figure 2-5. ATCBT Information Management Methods

In designing the prototype, decisions on who needed information, what information was needed, and when it was needed it were made as a result of a series of meetings with personnel from HQ MAC and the MDC. These meetings defined the outputs as a series of printed reports. In order to generate the reports, it was necessary to provide a way to identify the trainees and the lessons available. Information related to supervisors, trainee work areas, recurring training requirements, and other associated data also needed to be included in the database in order to manipulate data for the reports.

It was envisioned that the ULC would be the focal point for registering trainees, collecting all trainee data, and disseminating management information at the base level. It was anticipated that the ULC would then send the summarized data, via the Defense Data Network (DDN), to an electronic mail box which would be accessed by the MDC for further dissemination. As the information controller at the base, the ULC was responsible for maintaining the integrity of the database, including keeping the trainee roster updated as personnel entered or left the aerial ports.

For the purpose of the prototype, all information dissemination was reported via printed reports. The consolidation, summarization, and report generation of the performance data was implemented via a commercially-available database management program (dBase II from Ashton-Tate). By using a commercially-available database management program, it was possible to build in a flexible data management system which could be easily programmed for differing requirements. It was anticipated that the experience of the prototype would provide more detailed knowledge of what was needed in the field at all levels of management. The ULC monitors interfaced directly with the data management programs via a series of prompts and menus.

The data management options provided eight printed reports. These included: (1) reports to both the supervisor and student upon successful completion of a lesson examination, (2) a utilization report showing the lessons taken during a given period and the number of people taking them, (3) a report showing detailed and exact responses made during a lesson, (4) a report showing test item statistics across students during a given period, (5) a list of lessons available, (6) a list of those personnel registered to take lessons but not taking any, (7) a list of lessons during a given period for which there was no activity, and (8) an exception report which was intended to show trainees having problems.

The evaluation issues, results, and conclusions below were derived from a set of survey questionnaires administered to the ULC monitors at the prototype sites, as well as personnel from the MDC and HQ MAC. In the discussions with the ULC monitors, it was requested that they consider comments made by OJT supervisors and students who received reports or requested information, as well as their own observations or ideas as to what was useful. Most of the comments received were acquired during the last two weeks of the prototype evaluation in order to take full advantage of the experience gained. The descriptions below are a composite of the comments.

2.2.1.1 Information Management Procedures

ISSUE:

Were the ULC procedures for inputting database information and acquiring performance data reports adequately explained and easily used?

RESULTS:

o User Guide

The ATCBT User Guide, which explains the procedures for inputting student and lesson data as well as generating reports, was modified twice during the evaluation to reflect the need to clarify and expand

the instructions. During the installation at each prototype site, a demonstration with hands-on training in the use of the data management procedures was provided. In all cases, this seemed adequate and no negative comments were received.

- Inputting Trainee Registrations

  Suggestions received included providing a standard procedure and form for inputting information on trainees entering into a squadron so they could be entered into the system as quickly as possible. The 1st MAPS at Dyess AFB instituted a requirement for all cargo personnel entering into the squadron at 3- and 5-skill levels to take all cargo CBT lessons. This was done to refresh personnel in various training topics which were available in the prototype lessons. In the future, 1st MAPS plans to continue the practice in some form. This means new entries in the system must be made immediately.

- Registration Roster

  One shortcoming in the current procedures seemed to be the lack of capability to generate a roster of those people registered as trainees. This was overcome during the prototype by addition of a list function as a temporary solution.

- Performance History Data

  An area which had never been addressed in implementing the prototype was how long the performance data should be kept at the ULC. An associated question was how should the the trainee's performance data be sent to his or her next duty station. No policy or procedures were set as a result of prototype operational practice at the bases. Floppy disk copies of data were being kept. However, since the duration of the evaluation period was six months at the most, the problem of how long to keep data did not arise.

- Dispersal of Base Management Information

  The trainee registration file currently includes information related to the trainee's supervisor and work center. These were intended to allow designation of where a report should go. Variations were observed in how ULC monitors used the supervisor field. In some cases, the level of supervisor was at an immediate supervision level. In other cases, the supervisor was at a higher level. The question was raised as to whether the trainee reports could be grouped only by work center as opposed to supervisor. This would allow generation and dispersal of reports by work center allowing the work center to split up the reports to specific supervisors. A primary question of concern here was whether it was possible to keep the supervisors updated as personnel changed work areas or supervisors.

CONCLUSIONS/RECOMMENDATIONS

Revise the section of the ATCBT User Guide which provides instructions for data management to show examples of reports and procedural interactions with the data management routines (menus and prompts). Include procedures for in-

processing of new personnel, out-processing of personnel leaving the squadron (including what to do with their ATCBT performance records), and reflect the changes in report requirements discussed in the next section. Custom screens, which allow easier viewing of data, should be considered.

Establish a policy for how long the ULC should keep data on floppy disks and printouts. It is anticipated that the ULC will be the only depository for the data since no requirements have been identified on a regular basis for data at higher headquarters or the MDC. Rather, the data will be accessed by request from these other activities. It is recommended that AFR 12-50 be the basis for establishing the history-keeping policy. According to Table 50-4 of the regulation (rule 15), the training data should be destroyed "when superceded, obsolete, or no longer needed, whichever is sooner." It is recommended that, when a trainee leaves the port, he or she be given a printout of their record as well as sending the record over the DDN network to the new duty station if it is on the ATCBT system. The transmission should be studied further to determine its impact on time and resources.

2.2.1.2 Information Management Reports

ISSUE:

Were the reports useful? This issue includes questions related to what reports are needed, when are they needed, how should they be distributed and to whom, and how often should reports be generated?

RESULTS:

- Frequency of Data Summarization and Reporting

  Generally, each squadron summarized data and generated reports on the basis of the amount of activity that had gone on in the preceding period rather than a specific periodic basis. The 1st MAPS, for example, had periods of relative ATCBT inactivity when personnel were mobilized. There was no need to consolidate the data during these periods. Likewise, the other squadrons, Charleston AFB and Rhein Main AB, had times when activity was light as a result of exercises or other demands on time. Some constraints in the time available to the ULC monitor to generate reports was also evident. The time needed to consolidate data and generate reports was not always immediately available and sometimes data waited days to be processed.

- Reporting In-Progress Training Data to Supervisors

  There was almost universal agreement on the need to change the completion reports which were designed to be distributed to both the trainee and the trainee's supervisor. All units indicated that (1) only one report was needed for distribution to the supervisor (which would still be included in the trainee's 623 folder), and (2) the completion reports should provide a complete record of progress by lesson for the trainee. Currently, the report is only generated if the lesson examination is taken and then only the score on the lesson examination is provided. Supervisors indicated that they would like to know what progress is being made on a lesson regardless of whether or not the lesson exam is completed. In other words, if a student

started on one date and completed one segment of a lesson and then returned two weeks later for two more segments and had not returned for completion of the lesson exam, the supervisor would like to know when training was taken and what score the trainee received on each part of the lesson. This would allow the supervisor to know the pace of progress as well as the proficiency in specific areas.

o Reporting History Training Data to Supervisors

All sites identified the need for a trainee history report. This is currently not part of the data management process. The history report would include all lessons or parts of lessons taken by a student with the date and score. This data should be kept permanently as long as the trainee is at the port so that reports can be generated at the request of the supervisor or other managers.

o On-Line Queries by Supervisors

Some questions were raised as to the feasiblity and need for on-line access by supervisors to the history or current progress of an individual assigned to that supervisor. There was not a clear consensus as to the need for an on-line query capability. One ULC monitor suggested that it could, in fact, be somewhat dangerous to allow supervisors to have access to data at a terminal. Although various protection schemes could be implemented to ensure integrity of the data, the implementation of the on-line query would require modifications to the design of the CONTROL and communications programs, as well as the data management programs and files.

o Other Reports

Another report, which does not exist now and was identified by all sites as being needed, is a list of personnel registered on the ATCBT system. This was also mentioned in Section 2.2.1.1. This oversight obviously needs to be corrected. The listing of lessons, including recurring training requirement lessons, was considered adequate, especially as the number of lessons grow. The CBT utilization report was also judged to be adequate, although there were comments as to whether all data was included on the report. This probably relates to a problem with the algorithm which computes viewing time by terminals.

The reports which present the detailed response by item data and the test item analysis data were not subject to comment by the squadrons since the reports are not for their use. These reports are for the lesson validation. The data for the evaluation, the report recording actual incorrect responses, is normally collected only for developmental periods. However, during the prototype, all data was collected and analyzed by ISD, Inc. There were no negative comments on these reports from the MDC. However, the MDC would like the capability to receive supervisor comments on lesson content as part of the data management reporting function, rather than relying on written comments getting passed to the ULC and then sent to the MDC via DDN or mail.

The two file management reports, which present the list of students not showing lesson completions and the lessons not showing activity, were not judged disfavorably. However, it should be noted that the student printouts will list everyone who has not actually completed a lesson regardless of whether they showed some activity. Thus, in a squadron with 600 people, during a one-week time period, many people may not show activity and the list could be quite long.

CONCLUSIONS/RECOMMENDATIONS:

The completion report should reflect more detailed data including segment exam as well as lesson exam scores and the dates that any activity occurred for each student. This will allow the supervisor to more effectively judge the rate of progress and proficiency of personnel. This will also allow the supervisor to determine that adequate time is being spent in training that has been scheduled. The report does not need to go to the student.

An historical file system for each student should be implemented. This file will provide a report to contain all ATCBT activity as long as the trainee is in the squadron. The updated historical report could be (1) the printout included in the person's individual training record, (2) the report which could be accessed by supervisors, either through printouts or on-line access, and/or (3) the document which would be sent to the person's next duty station after leaving the squadron.

The need for on-line query by supervisors at the work station terminals needs to be reviewed further. Mildly conflicting judgements on the part of ULC monitors and other managers of training exist on this feature. It is feasible to provide the capability, within limits, while still providing protection of data files and their access. However, the exact query capability needs to be defined for the design to be scoped. Likewise, the requirements to allow supervisors to input lesson revision comments for the MDC on-line should be examined further. Modifications to the CONTROL software and data management files are anticipated to support these features. The CONTROL software handles all tasking, including background processing and communications.

The description of the data management process and procedures in the ATCBT User Guide need to be revised to reflect changes made for reports, on-line queries, or other changes which may subsequently be approved.

2.2.2 Organization Management

The ATCBT management methods related to organization are shown in Figure 2-6 below.

During the prototype evaluation, the primary concern was the organization responsibilities for base ATCBT operations, as opposed to higher headquarters such as Numbered Air Forces or HQ MAC.

Inputs -->	Process -->	Outputs
Organizational Elements Which Support Training Including: o ULC (Training Section) o OJT/Section Supervisors o 1492 ATTF, MDC o Squadron/Base Support Activities	o Process External Data Requests o Disseminate Corrective and Preventive Maintenance Information o Disseminate Operations Information	o Data Requests Filled o Correct PM and CM Procedures Used o Correct Operational Procedures Used

Figure 2-6. ATCBT Organization Management Methods

As seen in Figure 2-6, the organizational elements at the base level are the Training Section/ULC, OJT and section supervisors, several squadron/base support activities, and the 1492 ATTF (with particular emphasis on the MDC). These groups must work in concert to ensure correct operations and maintenance of the ATCBT. In addition, there are some support functions required from a central source such as the MDC for source and system information. The ATCBT organization issues relate to what responsibilities each activity must have.

2.2.2.1 Roles of the Training Section/ULC

ISSUE:

What roles must the Training Section (the ULC monitor in particular) play? For these roles, do the skills and time required match the existing people resources. Implied in this is that no additional manning is desired to support ATCBT implementation.

RESULTS:

o ULC Monitor's Role and Responsibility

The primary responsibility for the ATCBT system at each site rested on the ULC monitor and whatever staff was available to him. The ULC monitor was trained to operate the system, perform preventive maintenance, run diagnostics for corrective maintenance and obtain corrective actions, initiate summarization of performance data and dissemination of results in written form to the section supervisors; provide the proper adjunct materials for lessons; provide information on use of ATCBT to trainees and supervisors; and demonstrate ATCBT to interested parties.

o ULC Monitor's Background and ATCBT Training

Of three sites, only one ULC monitor had any appreciable experience with microcomputers of any sort. Thus, entry level into the position was in reality a non-computer user. Two monitors were AFSC 75172 (Training) and one was AFSC 60572 (Air Transportation). In the final

survey of ULC monitors, none felt that the skills required were too difficult. While some procedures could be made more efficient, none were beyond the attainment of a typical ULC monitor. Specific comments on ease of procedures and needs for job aids are covered later in Section 2.2.4.

o ULC Monitor's Time for ATCBT Duties

While the ULC monitors received the ATCBT concept and systems enthusiastically, they also expressed concern over time. They noted that the billet calls for several training support tasks in addition to directing the ULCs. Upgrade training, MHE training, filling formal school quotas, and administrative paperwork/records are part of the job. In addition, during installations at both Charleston AFB and Rhein Main AB, ULC monitors were part of preparation for exercise/inspections. Both of these squadrons are 600-plus-people organizations with sizeable training commitments.

CONCLUSIONS/RECOMMENDATIONS:

Since no additional manning is desirable or possible, the ATCBT procedures must be as labor efficient as possible. The success of ULC monitors to date indicates that their skills are sufficient to learn the duties required for ATCBT. The user documentation training and support must maximize the monitor's time, however, since it is limited. Continued efforts must be made to ensure that all of the tasks required of the ULC monitor are made more efficient. In addition, there are support functions recommended from other groups. These functions are beyond the scope of the ULC, but within the scope of the other groups (see Section 2.2.2.3).

2.2.2.2 Roles of OJT and Section Supervisors

ISSUE:

What roles are required of the OJT and section supervisors? Does ATCBT reduce or minimize the time required of a supervisor for training?

RESULTS:

o Supervisor Interest

An indication of supervisor interest in ATCBT is that about 50% of the people taking lessons on the system at the two larger aerial ports were 5- and 7-skill levels instead of the targeted 3-skill level. According to the ULCs, there was no doubt that part of the reason was that the supervisor needed to know what was there in order to recommend it or require it for subordinates.

o Saving Supervisor Time

It is difficult to tell how much time ATCBT saves supervisors in achieving training goals because the nine prototype lessons represent only a small sample of training needs. However, one antecdote illustrates the potential. The three lessons for AFSC 60530 cover the PACS (Passenger Automated Check-In) system which has just

recently been installed at Rhein Main. During installation, a supervisor at Rhein Main indicated that he learned the "why" of things he had been doing for several months and that the lessons provided some knowledge that he had to discover for himself. He indicated that all of his people would take the lessons as soon as possible. During the same week, several 605X0 supervisors from nearby Ramstein AB dropped in for a demonstration and, as a result, indicated that they would be sending all of their people to Rhein Main to take the three lessons.

o Supervisor Catalog for ATCBT

The need for supervisors to know what is available points to a problem which occurred at times during the evaluation. Although demonstrations were provided to supervisors and information was at the ULCs on which lessons were available, no "catalog" of lessons was disseminated at any site. It was pointed out by one ULC monitor that a catalog of lessons by work center would be useful as well as a general catalog. Summaries of lessons available were suggested for others, such as Branch Chiefs, Senior NCOs, and Commanders.

o HQ MAC Requirement to Use ATCBT

A meeting was held with 23 section supervisors and the OJT supervisor at Charleston AFB at the conclusion of the evaluation period. This meeting surfaced concern over whether HQ MAC would make any of the training mandatory. Supervisors stated that they wanted the freedom to make these decisions themselves.

CONCLUSIONS/RECOMMENDATIONS:

During each site implementation, demonstrations and hands-on experience should be provided to all supervisors. Periodic demonstrations should be held for new supervisors until all are familiar with the system.

Catalogs should be developed by the MDC to be disseminated by the ULC during implementation. Updating should occur with new lessons. Catalogs should describe content, objectives, relationship to STSs, prerequisites, and other general information by which supervisors can select training to meet an individual's job training requirements and upgrade training.

2.2.2.3 Support to the ULC by Other Squadron/Base Departments

ISSUE:

What existing organizational resources can assist the ULC in reaching ATCBT goals?

RESULTS:

During the prototype evaluation, several incidents occurred in which support was provided by other departments. These may serve as a model for the future.

First, although the ULC monitors were trained to perform preventive maintenance, including cleaning the inside of computers and running diagnostic programs to isolate faulty components, they were limited in technical knowledge to remove and replace components. At Rhein Main, the systems section which cares for CAPS, helped out by isolating a faulty hard disk and then swapping a good disk from another down machine. This assistance provided minimal downtime for one machine. The skills required were not part of those taught to the ULC monitor, but are in the repertoire of almost any computer technician familiar with personal computers.

The second incident occurred at Charleston AFB. The phone switching system (the on-base PBX) turned out be an older, mechanical type which can be very noisy for the data communications needed for ATCBT. The squadron communications experts assisted in determining possible corrective actions.

CONCLUSIONS/RECOMMENDATIONS:

The ATCBT User Guide should include discussions of possible squadron and base resources to use when available and when approved. These resources may be especially important to non-CONUS sites. HQ MAC may want to provide a formal statement of support required.

Another form of support will be encountered during the implementation of sites with "satellites." For example, Oakland International Airport is a satellite to Travis AFB. It will be necessary to establish who needs the skills and is responsible for what tasks. That is, are the satellites functioning as ULCs or as a remote site to the central ULC? Each site implementation should have a designated individual(s) to accomplish the tasks described in Section 2.2.2.1.

2.2.2.4 Support to the ULC from the MDC and the Site Installation Team

ISSUE:

How can ULC skills be supplemented by other MAC expertise available?

RESULTS:

During prototype implementation, the contractor visited each site from three to six times, kept frequent phone contact, and responded to questions and problems which occurred. Many of the contacts were required because the system was in the prototype stage and they will not occur during the command-wide implementation. However, as each of the sites are implemented, it should be expected that, regardless of initial training and support materials such as the ATCBT User Guide, the ULCs will have more questions and unanticipated problems, or personnel turnover requiring new support.

CONCLUSIONS/RECOMMENDATIONS:

ATCBT field support should be transitioned from the contractor to the MDC. The MDC participated in all the prototype installations, surveyed the test sites, is on the DDN net, and has been kept abreast of questions from the field. ISD, Inc. should continue training the MDC to provide this operational support function and act as an additional, but second-line, resource to the MDC and ULCs.

2.2.3 Lesson Management

During command-wide implementation, approximately 200 hours of CBT instruction will be developed, validated, and disseminated to the field by the MDC. In addition, revisions to lessons already in the inventory will be required with updates distributed to the field. Section 2.3.4.3 covers specific MDC lesson management procedures. However, Figure 2-7 presents the elements for lesson management at the ULC.

INPUT	-->	PROCESS	-->	OUTPUT
o New lessons o Lesson Updates		o Distribution by MDC to ULC o Distribution by ULC to Work Station o Dissemination of - Catalogs by MDC and ULC		o Controlled inventory up to date at all locations o Catalog information complete

Figure 2-7. ATCBT Lesson Management Methods

ISSUE:

What experience was gained during the prototype evaluation to suggest lesson control and distribution procedures?

RESULTS:

During the evaluation, it was necessary to send out new disks to each site for three of the nine lessons. These lessons were revised to include unanticipated responses. In order to make lesson updating easy at the ULC, a floppy disk was mailed with an MS-DOS .BAT file which contained all commands necessary for updating the lessons. The ULC monitors typed "UPDATE" at each station. ISD, Inc. also distributed new CONTROL boot disks which contained changes (invisible to the users) to lesson control files for the purpose of downloading the lessons.

CONCLUSIONS/RECOMMENDATIONS:

These specific procedures for the MDC and the ULC need to be documented for dissemination of the large number of lessons scheduled. ULCs should have the option of deciding whether to copy disks or download.

In addition, the CONTROL software and data management programs need to be modified to make updating simpler and reduce the lesson information files.

Finally, the procedures for updating and disbursing the ATCBT catalog of lessons to all levels of users must be established.

2.2.4 Equipment and Software Management

The ATCBT terminals are intended to be available at work stations on a 24-hour, continuous operating basis. The work stations are in passenger terminals, freight areas, and other areas remote from the ULCs. Figure 2-8 presents the elements for equipment and software management.

INPUT	-->	PROCESS	-->	OUTPUT
Computer hardware and software at work stations in 24-hour, 365-day operations	o	Operational tasks at all stations	o	Maximum availability of machines
	o	Preventive maintenance	o	Provide self-sufficiency at squadron locations remote from ULC
	o	Corrective maintenance		

Figure 2-8. ATCBT Equipment and Software Management Methods

ISSUE:

What operation and maintenance procedures need to be followed by ULC monitors and other personnel?

RESULTS:

- o ULC Monitor Operations

  Several incidents occurred which demonstrated the need to provide more specific reference instructions to the ULC on operations which had not been sufficiently described. These operations included (1) backing up student registration and lesson registration files on floppy disks, (2) backing up performance data files, (3) maintaining a library of disks of various software, (4) formatting disks, (5) using DDN to transmit data, and (6) alternative data collection on floppy disks when communications were not operable. Procedures to explain the why and how were written as the need arose. In most cases, the write-ups went through at least one revision after validation by ULC testing.

- o Work Station Operations

  The ULC monitors had no problems operating the equipment. However, there were several incidents at the work stations which pointed to the need for others to perform basic operations such as power on/off, setting the systems for booting up, and assisting new personnel on the systems at the work stations.

  When severe thunderstorms occur at Charleston and Dyess, the policy is to turn off all computers; even with power surge protection. This means the systems must be turned on later with the proper disk inserted. Since this may occur when a ULC monitor is off shift, or even during the day when other duties are being performed, it means someone else must do it. Questions also arise at the work stations

from new trainees about how to use the terminals, the keyboard, the lessons available, etc.

- Preventive Maintenance Procedures

The need for several new preventive maintenance procedures was demonstrated during the evaluation. For example, at Charleston AFB an already "dirty" environment was made worse when the forced air heating was turned on. A large amount of soot and dust found its way into the two machines in the freight area, as well as the one at the ULC. All three went down and would not respond normally over a period of mid-December to mid-January.

The problem was solved by cleaning the inside of the machines with a small, battery-operated vacuum, static-free cloths, and a pencil eraser. The ULC monitor was shown how to do this and was provided with written instructions. No further problems occurred. It should be noted that, at the passenger terminal, the section supervisor had been cleaning around the outside of the machine regularly with a hair blow dryer. This machine was very clean inside when checked.

Other procedures which were needed included (1) making new boot disks (which get dirty or are handled incorrectly in the 24-hour operations), and (2) reformatting hard disks when they crash from power outages or have other noncritical hardware malfunctions. The ULC monitors were able to perform these tasks when given written instructions and the necessary resources.

- Corrective Maintenance Procedures

Maintenance management, both preventive and corrective, was considered to be one of the most critical areas to be resolved for command-wide implementation. It was recommended by the contractor that no commercial contract be made for maintenance of the hardware.

A 90-day warranty was provided by AT&T for equipment purchased from them. During installation, ISD, Inc. took responsibility for contacting AT&T or replacing other equipment under warranty if it did not work upon "opening the box." In addition, the warranty covered problems with a display monitor and modem at Charleston and a keyboard at the MDC. Actions were taken by personnel at the site with assistance from ISD, Inc.

Problems after the warranty period included: (1) none at Charleston AFB, except for internal cleaning required as preventive maintenance, (2) a bad disk and possible processor/mother board defect at Rhein Main AB, (3) none at Dyess AFB, and (4) a possible processor/mother board defect at the MDC. The problems at both Rhein Main and the MDC are pending corrective actions. Form 9's must be filled out, vendors identified for work, and the mechanics of getting the machines or components to a repair vendor are in process.

CONCLUSIONS/RECOMMENDATIONS:

The ATCBT User Guide needs to have operating instructions and preventive maintenance procedures added for both the ULC monitor and supervisors at work stations. Reference material should be included in the User Guide for preventive and corrective maintenance actions, including use of the form 9's, how to find vendors, where to get base support, and how to specify local maintenance contract needs. An oversight in the prototype evaluation was that "ownership" of the equipment was not officially transferred to the squadrons. This meant they could not get approval for repairs. This has been corrected and will be done in all future implementations.

The Air Force-wide small computer maintenance contract, to be awarded in the next several months, should be studied to determine its usefulness to ATCBT.

2.2.5 Facilities Management

As shown in Figure 2-9, facilities includes power, communications, space, furniture, supporting material, and environmental factors.

INPUT	-->	PROCESS	-->	OUTPUT
o Power requirements o Communication requirements o Space/furniture/support material requirements o Environmental factors		o Prepare facility o Maintain facility		o Minimize equipment downtime o Provide adequate area for work station learning

Figure 2-9. ATCBT Facility Management Methods

ISSUE:

What are the facility preparation and maintenance requirements for ATCBT?

RESULTS:

o Power

Power outlets sufficient for each machine were required. Normally in CONUS, this meant one outlet (receptacle) per machine since each machine was connected through a surge protector. If an external modem or printer was at the station, these were also connected through the surge protectors. The surge protectors proved necessary and adequate. Electrical storms at Charleston did cause problems, but the surge protectors avoided potentially serious problems with the computers.

Two other factors are relevant to European and Asian installations where the power will not be 110V, 60 Hz. Experience at Rhein Main (220V, 50 Hz) illustrates the alternatives. The AT&T 6300 has a power supply which is set for the U.S. 110V, 60 Hz, but can be switched to the European 220V, 50 Hz setting via jumpers in the back of the chassis. However, at Rhein Main, transformers were used since (1) the printers and external modems were not switchable to other than 110V, and (2) transformers were readily available.

Two problems occurred. First, surge protectors could not be used unless transformers of higher ratings than usual were used. The surge protectors pulled so much power that the entire ground floor of the ULC building was blacked out when even a 2000 watt transformer was used and a fuse was blown. Second, an older, faulty transformer was used in error one day at the ULC which resulted in another blown fuse and a "crash" of the hard disk. The "crash" resulted in loss of data and data management programs.

o Communications

Communication orders for the prototype implementation called for a Class C line with an RJ-11 jack at each CBT terminal for on-base data and lesson transmission. In addition, a commercial line at the ULC was requested for access to DDN and the uploading of data summaries to the MDC. Variations in the actual implementation ocurred as follows.

First, the 1st MAPS at Dyess AFB needed their two machines in the same room. They will move to another building in several months at which time the machines will be about 30 feet apart. They are currently 2 to 3 feet apart. It did not make sense to install Class C lines. Instead, the ATCBT CONTROL software was extended to support a null modem, direct cabling of two machines with no modems. A commercial line was installed for DDN.

Second, Rhein Main AB could obtain either Class C or dedicated lines. Class C lines were chosen because dedicated lines were more expensive and not as easily moved. No problems were experienced with the Class C lines. It should be noted that the base switching system is overloaded, which results in daytime periods with busy signals all over the base. The ATCBT system was not hindered by such circumstances.

The Rhein Main AB site was a good test of the ATCBT communication concept because of the differences from CONUS. Special requirements for modems were incorporated in the final specifications due to the European phone system and CCITT protocol. The ATCBT system was not hindered by such circumstances. The ULC modem hookup to DDN is not possible in Europe. However, the ULC uses another squadron DDN facility with a direct line to a DDN host.

Third, Charleston AFB installed Class C lines and a commercial line for DDN. After several attempts and tests of the Class C lines, it was concluded that the noise on the lines was just too much. The ATCBT messages and data were being distorted or destroyed by the line

noise such that about 40 to 60% of the calls could not be completed successfully. Based on this experience, a set of minimum specifications have been developed for communications orders. The Charleston base switching system is the older, mechanical type for which not much, if any, line conditioning could be done. The plan is to implement dedicated lines.

It should be noted that the Charleston base switching system represents the worst possible case and is unlikely to be found at other bases. In fact, most bases are being upgraded to all digital switching, the latest in the state-of-the-art. Dyess AFB already has this system. The new systems are made for integrated voice and data networks and will support the ATCBT operational concept well. In addition, it may be possible to increase the rates of transmissions thereby making the data transmission even less visible than currently and lesson downloads more feasible (they take 10 to 20 minutes at a 1200 baud rate).

o Space/Furniture/Material Requirements

None of the three prototype sites used any special furniture. Tables and standard desks and chairs are being used satisfactorily. However, all bases indicated intentions to put personal computer type carrels in the work stations. Because all sites had nylon carpeting and some had severe electrical storms, ISD, Inc. recommended that they acquire static-reducing floor mats. Most stations have these. The space required for any work station is no more than it takes for a small work table or desk. In several instances, the CBT terminals are placed in unused corners of rooms where they are accessible but not in the main flow of traffic. In other cases, the stations are in small rooms with a door which can be closed if the area is noisy. All sites were given starter cleaning kits, including disk head cleaning, CRT cleaning, etc., to maintain the machines. These kits cost a minimal amount and are easily replaced. Other consumables include printer paper and ribbons, floppy disks, and disk storage containers.

o Environmental Factors

Environmental factors of relevance include heat, cold, humidity, electricity/static, dirt in the air, and items such as cigarette smoke, drinks, and food. All prototype sites put signs at the work stations which prohibit any food, drink, or smoking at the terminals. Beyond that, other precautions already mentioned were surge protectors (except Rhein Main), static-protect floor mats, and preventive maintenance cleaning. These precautions proved adequate. No problems have been caused by environmental factors which cannot be prevented by these precautions. The terminals, in most instances, were operating 24 hours a day in a relatively hostile, non-office type environment.

CONCLUSIONS/RECOMMENDATIONS:

Transformers should be used in non-CONUS sites since not all equipment will be convertable. The contractor should investigate the use of higher-rated transformers for non-CONUS sites so that surge protectors may be used with transformers. New transformers should be acquired and they should be planned for replacement periodically (probably 1 to 2 years) since they do deteriorate and this may damage ATCBT equipment.

A summary of all sites needs to be completed to determine the capability to meet the minimum communication specifications and to determine the type of PBX system available so that the ATCBT CONTROL programs, modems, and port switching can be configured properly. Orders must be issued at least 90 days in advance. CONTROL software should be modified to provide for cases where dedicated lines and digital, integrated systems are used for communications. Error protocols and retry algorithms should be enhanced.

The ATCBT operational concept of (1) placing the terminals at the work stations, and (2) requiring around-the-clock operation in a non-protected environment seems sound. The stations are operating normally. The number of problems which have occurred do not exceed those expected in a more protected, 8-hour-a-day environment.

2.3 Production Component

The ATCBT production configuration was designed to meet the needs of the MDC as a centralized CBT production capability. To better understand these needs, a brief description of the responsibilities of the MDC is provided below.

The MDC is the Office of Primary Responsibility (OPR) for a number of training programs (including both slide/tape and programmed text). It will be the OPR for the ATCBT lessons as they are developed during command-wide implementation. As an OPR, it is tasked with creating, reviewing, standardizing, distributing, and purging training materials for the ULCs worldwide. The MDC also serves as a preview/review agency for all HQ AFRES Air Transportation training materials.

During the evaluation period, the MDC staff was tasked with inventorying all slide/tape programs (regardless of OPR) and indicating their status as current, requiring revision, or obsolete. As a result, the Transportation Training Program Catalog was developed by HQ AFRES, with the assistance of the MDC, listing all available training material for AFSC 605XX, including printed materials, slide/tape programs, and CBT lessons (as they become available). The MDC coordinates with HQ AFRES to update this catalog of ULC/AFRES training materials on a quarterly basis.

The evaluation of the production component at the MDC focused on four specific objectives:

1. The ease of use of the ATCBT authoring environment.

2. The efficiency of the graphics development process.

3. The adequacy of the prototype system configuration.

4. The requirements for lesson production and maintenance.

The results of the evaluation are organized into four categories in the following subsections: (1) the authoring environment, (2) graphics development, (3) the prototype configuration, and (4) lesson production, maintenance and management.

2.3.1 Authoring Environment

There are several issues to consider in evaluating the ease of use of the authoring environment. These issues center on the ability of non-programmers to author lessons, the usefulness of the authoring training workshops and User Guide, the "learning curve" and time to develop lessons, and the requirement for modifications and enhancement to the ATCBT authoring prototype. The issues, results, and conclusions/recommendations are described in detail below.

2.3.1.1 Non-Programmers as Authors

ISSUE:

The major criterion for designing the production component was the requirement for non-programmers to author CBT lessons. The issue becomes, "Can the MDC staff produce CBT lessons using the ATCBT authoring environment?"

RESULTS:

The MDC staffing level is set at six enlisted personnel with Air Transportation instructor experience. There were three MDC personnel at the beginning of the evaluation in June with the fourth added in August, the fifth in November, and the sixth in December. Therefore, not all members of the staff have extensive hands-on authoring experience at this point. One CBT lesson was completed during the evaluation and three CBT lessons are in progress and scheduled for completion by 1 April 1986.

CONCLUSIONS/RECOMMENDATIONS:

The design of the ATCBT authoring environment does provide the non-programmer staff of the MDC with the capability to author CBT lessons. The MDC personnel were able to research a topic area, design a CBT lesson using the lesson specification guidelines, input the lesson content unit by unit, "run" the lesson as a student would see it, and then edit the units for better presentation. The CBT lesson completed during the evaluation period is well constructed, presented in an interesting manner and interactive for a student. The authoring/editing user guide and hands-on training workshops provided by ISD, Inc. appear to be useful in preparing the MDC personnel to author CBT lessons.

2.3.1.2 Slide/Tape Versus CBT Production

ISSUE:

As an OPR, the MDC is tasked to produce slide/tape programs for the ULCs. It is anticipated that this requirement will eventually be replaced by CBT lesson production and maintenance. However, during the evaluation period, the MDC staff developed five slide/tape programs, starting with research through editing to final production. Since the topic of one of the slide/tape programs was also designated as a CBT lesson, this provided an excellent opportunity to compare slide/tape production time against CBT production time. The question is, "Is is possible that CBT development can reduce the time required to produce training for the ULCs?"

RESULTS:

Development of a slide/tape program on the topic "Terminal Security/Anti-Hijacking Procedures" began 3 September 1985. Development of a CBT lesson on the same topic began 23 December 1985. The CBT lesson was completed by 14 February 1986, while the slide/tape program is still in process. Most of the time delay associated with the slide/tape production is the result of audiovisual coordination with DAVA. DAVA is responsible for all slide reproduction, audio production, and mailing to the 55 stations supported by MAC. There is a significant amount of stagnation time before slide/tape programs are disseminated to the field for training. This time, plus the additional costs of reproductions and narrations incurred by DAVA, need to be considered when looking at overall slide tape production.

The times devoted to the major production stages for each medium are shown in Table 2-4. The times are based on production time sheets kept by the MDC author. To date, the total number of hours for the CBT lesson production was slightly more than that for the slide/tape production. However, the slide/tape production has not been finished and actual hours for DAVA processing are not included.

Table 2-4

Hours for MDC Lesson Production in Two Media

Media	Research	Development	Typing/ Input	Review/ Editing	Graphics/ Photography	Total
CBT	60.00	82.00	45.00	41.00	82.00	310.00
S/T	24.50	74.00	32.25	80.50	13.00	224.25

CONCLUSIONS/RECOMMENDATIONS:

The development of CBT lessons can decrease the time required to produce training for the ULCs. Even during the initial "learning curve" for CBT authoring, the number of hours per hour of instruction is comparable to those required for slide/tape development. In addition, since all of the CBT production occurs in-house at the MDC, coordination time with DAVA is eliminated, and the total time to get training out to the ULCs is reduced.

2.3.1.3 Modifications to Authoring Prototype

ISSUE:

The ATCBT authoring prototype produces standardized lessons containing a set of structured instructional units. The author only needs to respond to a sequence of prearranged prompts in order to generate a lesson. The instructional units and prompts in the ATCBT prototype were designed by ISD, Inc. with inputs from the MDC staff. The issue here is, "Does the ATCBT authoring prototype, as currently designed, meet the needs of the MDC operating in a CBT lesson production mode?"

RESULTS:

Based on MDC comments, the ATCBT prototype needs to be modified to better meet the authoring requirements of the MDC. Specific problems and solutions are provided below.

- Introduction

  Problem: Currently the prototype is only set to introduce a lesson with a text title page. At times, a graphic title page might be more effective as an introduction.

  Solution: An option should be available to the author to allow either a text or graphic title page.

- Learning Objectives

  Problem: The learning objectives, as currently stated in the prototype lessons, are not consistent with the "Gronlund"-type format used by the Air Transportation Training Command (ATTC) formal school.

  Solution: Revise the authoring prototype to specifically prompt an author to input learning objectives in the format used by the formal school.

- References

  Problem: The references used to develop a lesson are not formally displayed in the actual lesson run-time, possibly causing future problems in identifying lesson(s) that are subject to update due to policy/technical manual change.

Solution: Revise the authoring system to prompt an author to input the references at the lesson and segment levels to provide (1) a revision audit trail and (2) more authority to the content.

- Lesson Title

Problem: There are currently two locations in which an author must input the lesson title, causing duplicate effort.

Solution: Change the prototype to either have only one occurrence of the title in the lesson, or store the title and redisplay it as necessary.

- Text Entry

Problem: Currently, text entry is done line by line with no option to return to previously entered lines. This is especially a problem when the main body of a segment must be entered and structured to provide "full-page" text screens.

Solution: Revise the prototype to provide on-screen editing of major portions of text.

- Color Standardization

Problem: Currently, prompts for student entry are presented in yellow. In order to further establish conventions for standardized lesson formats, a common color-coding of text must be established.

Solution: Utilize the following color conventions for future lessons: default color of green for general text; magenta and white for special emphasis of a word or words; turquoise for notes, yellow for cautions, and red for warnings, hazards, dangers and safety precautions.

- Prompts to Press a Key

Problem: When the color monitor is in graphics mode, the prompt to "Press any key to continue" occurs at the bottom of the screen with the lower half of the letters cut off.

Solution: The developers of CDS II should be able to redisplay the prompt up one line so it is no longer "clipped".

- Entry of Lesson Filename by Author

Problem: There is no information at startup for the author to enter a lesson filename no longer than 8 characters.

Solution: The developer of CDS II should explicitly include a prompt for a filename of no more than eight characters.

CONCLUSIONS/RECOMMENDATIONS:

The modifications to the ATCBT authoring prototype should be one of the initial tasks performed under command-wide implementation. Lessons using the current prototype will need to be reviewed and revised to reflect the changes and ensure the format is standardized. The more CBT lessons in the inventory that are produced prior to prototype modification, the greater the lesson revision requirement.

2.3.1.4 Enhancements to the Authoring Prototype

ISSUE:

The current ATCBT authoring prototype was designed to provide a basic structure and standardized format for lessons. During the development of the nine CBT lessons for prototype evaluation, it became clear that there was a requirement to enhance the authoring prototype.

RESULTS:

An upgrade to the CDS II authoring software is now available to enhance the current ATCBT prototype as well as develop new prototypes. New prototypes are based on specific content requirements that extend across several lessons. There appear to be a number of content area/presentation requirements that could warrant specific prototypes. For example, filling in PACS screen masks and simulating ADAM III terminal displays are both content areas in which specific authoring prototypes could be made available.

CONCLUSIONS/RECOMMENDATIONS:

It is recommended that the current version of the CDS II authoring software be upgraded. The latest version of CDS II includes a number of new features that were not available when developing the original authoring prototype. However, the update will not impact the lessons previously developed. The requirement for enhancing the current prototype and developing additional prototypes to support MDC lesson production should also be included as one of the initial tasks for the command-wide implementation. authoring/editing user guide will also be revised to reflect the changes/upgrade in the authoring prototype.

2.3.1.5 Software for Field Replication

ISSUE:

The MDC does not have the software to replicate the workstation training environment.

RESULT: To replicate the training environment, the MDC needs to license copies of the CONTROL software and CDSX, the lesson run-time software for lessons developed under CDS II. Without CDSX and CONTROL in combination, lessons cannot be presented as they are to students in the field.

CONCLUSIONS/RECOMMENDATIONS:

The MDC production stations should be upgraded for command-wide implementation. Copies of both the CONTROL software and CDSX should be acquired.

2.3.2 Graphics Development

The MDC used a mouse and standard graphics software package to develop picture files (PICS) for the CBT lessons. These files are accessible by CDS II to display full-screen pictures within a lesson. During the evaluation phase a library of over 150 graphics was developed, based on illustrations in technical manuals, CDCs, and slides from existing slide/tape programs. The library of graphics was developed to provide a resource for later anticipated CBT programs.

The creation of this library of picture files provided a good baseline for evaluating the use of the standard off-the-shelf graphics software package used with a mouse. Specifically, three issues were evaluated: (1) use of an off-the-shelf graphics package by non-artists to create appropriate pictures for CBT lessons, (2) alternatives to improve production time for a "typical" picture, and (3) text size when the monitor is in graphics mode.

2.3.2.1 Use of a Graphics Package

ISSUE:

Can non-artists utilize a graphics package to develop pictures?

RESULTS:

It was determined that non-artists can indeed develop graphics with a degree of sophistication that is appropriate for the lesson content. Of the 150 pictures created by the MDC staff, all were of a quality that reflected the important, essential points illustrated in the original visual (i.e., figures from a technical manual or 35mm slides from slide/tape programs). Examination of the dates on the pictures files did not show any significant "learning curve" associated with the prototype input device and graphics software. This level of production is shown in Table 2-5.

CONCLUSIONS/RECOMMENDATIONS:

During the evaluation period, the MDC personnel were using the mouse as an input device to develop graphics with a degree of sophistication that was easily attainable and not subject to improvement (because of the restrictions of the hardware/software). Thus, full-screen graphics could be produced by non-artists with little "learning curve" time expended.

2.3.2.2 Production Time

ISSUE:

The current mode of using a mouse to produce graphics for inclusion in lessons has been reported as being time-consuming and inadequate. The issue becomes, "What alternatives are available to improve graphics production time?"

RESULTS:

The input device supplied with the PC Paint software is a Mouse Systems optical mouse. The optical mouse was initially chosen because it was not subject to wear and had a projected long "lifetime". Use of the mouse to input a graphic was reported to be time-consuming. Of the four main steps in graphics production (research, layout, initial line drawing and color/detail), the initial line drawing using the mouse was reported to take the majority of time, with later addition of color and detail taking much less time. Because the initial drawing took the most time, alternate input/tracing devices may be required in order to speed production.

Table 2-5 shows that the type of graphic affected the total production time. For example, an average of 1.2 hours was devoted to a graphic of a form, as opposed to almost four hours devoted to a graphic of a piece of equipment or other situational scene. Alternate graphic devices, such as digitizer tablets and video digitizers, will impact equipment/scene graphics the most, with little impact on illustrations of forms. The features of digitizer tablets and video digitizers are discussed below.

- Digitizer Tablets. There are a variety of digitizer tablets which could be interfaced to the ATCBT system. These range in price from around $300 to $850. The current graphics development software (PC Paint) does not directly support a bit pad, but the Dr. Halo graphics package now available as a CDS II option does have digitizer tablet interfaces. Table 2-6 lists several digitizer tablets that interface with the Dr. Halo software available for CDS II and available for microcomputers.

Table 2-5

MDC Developed Graphics

	Pre-Dec 85			Dec 85			Jan 86			Total		
Type	Hours	Number	Average	Hours	Number	Average	Hours	Number	Average	Hours	Number	Average
Forms	15.82	29	0.54	57.50	39	1.47	25.25	12	2.10	98.57	80	1.23
Equipment/ Other	119.75	24	4.98	21.50	7	3.07	54.00	18	3.00	195.25	49	3.98
Total	135.57	53	2.56	79.00	46	1.72	79.25	30	2.64	293.82	129	2.28

Table 2-6

Digitizer Tablets

Company	Product	Resolution	Size	Price
Versa Computing	VersaWriter	320 x 200	8-1/2" x 12"	$299
GTCO Corp.	Micro Digi-Pad	200 lpi	6" x 6" 12" x 12"	$400 NA
Hitachi	Tiger Tablet	1000 lpi	11" x 11" 15" x 15"	$858 $1721
Summagraphics	MM Series	100-1000 lpi	6" x 9" 11.7" x 11.7"	$600 $800
	Bit Pad 2	1-1016 lpi	11" x 11"	$840

- Video Digitizers. Video digitizers allow the capture and digitization of photographic or videotape images. The systems consist of an add-on board and video camera along with various image processing software capabilities. These provide a digitized video frame to whatever graphics display board is used by the system. The major tradeoffs are resolution and number of colors. In order to present a highly realistic color image, a large number of colors are required (e.g., 65,000). A combination of image thresholding and pseudo-color capabilities would allow a photo image to be "posterized" (i.e., reduced to a small number of intensity levels and colors (therefore reducing memory storage requirements). Most PC digitizers sample at between 4 and 8 bits. That means they produce between 16 and 256 grey level intensities. The number of colors is determined by the capabilities of the display board and imaging software's pseudo-color capabilities.

  Digitized video takes up greater amounts of memory storage than simpler graphics approaches, especially as the level of resolution and numbers of displayed colors increases. Image compression software decreases the memory requirements to a level which would be practical in the current memory-limited ATCBT system. Use of CD-ROMs, videodiscs, and optical recorders might make the use of realistic video images practical, but will cause an increase in cost of $1,000 to $1,500 at each delivery system.

Several video digitizer systems are listed in Table 2-7. Most companies provide a range of hardware and software for image capture and digitization, with prices ranging from around $2,000 to $6,000. One of these systems (Chorus Data System's PC Eye) does not require any specialized display board for the digitized image at the delivery system. PC Eye produces PIC file formats that can be accessed by Dr. Halo graphics software. CDS II already supports Dr. Halo graphics, so there is no additional cost to implement special graphics routines in CDS II. If new CDS II driver software is required to support any new PIC file formats resulting from alternate video digitizers, this would require a one-time cost of approximately $5,000.

Table 2-7

Video Digitizers

Company	Product	Digitize Level	Resolution	Price
Imaging Technology	PC Vision Frame Grabber	4-bit 8-bit	512x480	$3095 $3495
AT&T	Image Capture Board		256x256	$1295
	TARGA Frame Grabber 16		512x512	$2995
	TARGA RGB Camera			$1295
	True Image Paint S/W			$695-1250
	System Total (w/o stand)			$3280-5540
Chorus Data Systems	PC Eye Digitizer	6-bit 8-bit	320x200 640x400	$610 $1495
	Camera			$270-1915
	Stand/Tripod, etc.			$215-295
	Dr. Halo Software			$99
	System Total			$1194-5849

CONCLUSIONS/RECOMMENDATIONS:

An upgrade of input devices to the digitizer tablet would better meet the MDC's graphics production requirements. A Summagraphics MM series tablets is recommended because of size (neither too big or small), cost, input resolution, and its representation of newer technology. Its ability to be used with Dr. Halo graphics software (which allows the digitized pictures to be accessed by the CDS II lesson software) without the need for additional graphics boards is another benefit. Furthermore, transition to Dr. Halo software from the PC Paint software will not impact previously developed graphics; the PC Paint-generated graphics can be converted to a Dr. Halo format with minimal time and effort. The upgrade to a video digitizer would normally not be advisable at this time. Many digitizers require display boards that would need to be incorporated in all delivery systems. However, the Chorus Data System's PC Eye interfaces with the Dr. Halo software described above, and does not require a special graphics board for delivery. For additional graphics production, the PC Eye system could be acquired on a trial basis to be implemented at the MDC.

2.3.2.3 Text Display

ISSUE:

The font size used to display text on a picture file is too large, especially when a form needs to be illustrated.

RESULTS:

Currently, when a lesson is produced, the text line to be inserted on a picture is restricted to 40 characters (which is the state the monitor switches to when in graphics mode). The vertical height of characters is also enlarged. This expansion of characters restricts the amount of information that can be presented.

There are two ways in which text is displayed with a picture: (1) by putting the text onto the picture itself, or (2) by creating a "window" in which text input through the authoring system is displayed. Additional fonts (in sets of five) can be purchased for the current graphics software to put text onto the picture. Some of these font sets contain smaller type faces. For text entered through the authoring system, only one single text size, which is enlarged when the monitor is put into graphics mode, is currently available. One of the updates for CDS II is to provide alternate-size characters ("shape sets") in which a smaller type face can be accessed for text entry as necessary.

All text fonts are limited to the resolution of the screen (i.e., there is a minimum number of pixels required to make one text character distinct from another). The standard AT&T color monitor displays color graphics at medium resolution (320x200 pixels), with higher resolution (640x400 pixels) available for monochrome characters. For graphics that require a lot of text (e.g., AF Forms), an option to switch to monochrome as needed may be desirable. The possibility of implementing such an option needs to be further discussed with the CDS II programmers. The new release of an advanced CDS II allows for calls to programs external to CDS. This may be a way to reach the monochrome resolution.

Another option (though costlier) would be to update the color graphics resolution at each production station and, consequently, each delivery station. At the beginning of the ATCBT project, the standard graphics resolution available for IBM compatibles was 320x200 pixels. Since then, a number of new high-resolution boards with a 640x400 resolution have become available. These boards offer four times the resolution of the current ATCBT delivery systems. In addition, there are a variety of software packages available for them. The CDS II software currently supports only a videodisc overlay graphics board (by New Media Graphics), although support for conventional 640x400 boards is expected later in 1986.

Upgrading to 640x400x16 colors resolution would increase the cost of each delivery system by approximately $600-2,000. Add-on boards currently available for IBM-compatible PCs are listed in Table 2-8. If the delivery stations continue using the AT&T color monitor, which currently interfaces only with their proprietary graphics board, then these higher resolutions cannot be made available. In that situation, the only recourse is to purchase alternate monitors that can be driven by one or more of the boards listed.

CONCLUSIONS/RECOMMENDATIONS:

The acquisition of the new release of CDS II should best satisfy the need for smaller fonts. The new release will provide the use of alternate character sizes when authoring. Also, the new release may provide a means to access other programs that will display "boilerplate" graphics, such as forms, with the monitor in the higher resolution, monochrome mode.

2.3.3 Prototype Configuration

The current configuration for the production component is three ATCBT systems: one 10-megabyte hard disk system, two dual floppy systems, one modem, one draft quality graphics printer, and three graphics packages. In order to meet the lesson production schedule, this configuration must be expanded and upgraded to extend the MDC capabilities.

2.3.3.1 Authoring Stations

ISSUE:

The number of authoring stations may not be sufficient to meet the command-wide lesson production requirements.

RESULTS:

The MDC has a full-time staff of six authors to produce and validate CBT lessons, revise CBT lessons, develop graphics, and perform data management functions. To meet the command-wide implementation schedule, two additional authoring stations and one additional draft quality graphics printer are required. One station configured for data management routines and connected to a modem for DDN access is sufficient for command-wide implementation.

Table 2-8

High Resolution PC Add-On Boards

Company	Product	Resolution	Colors	Display Memory (K)	Price
Array Technology	Graphics Solution	720x348	16	64	$299
Conographic	Cono-color 40	640x400	16	128	$995
Control Systems	Artist Transformer	640x480	16-4096	160	$1795-1995
	Artist II	640x400	16-4096	128	$1195-1395
Emulex/Persyst	BoB Super Display Adaptor	640x400	16	16	$525
Everex	Graphics Edge	640x400	16	4	$499
Frontier Technologies	CADgraph-2	640x480	4-16	256	$995
IBM	Enhanced Graphics Adaptor (EGA)	640x350	64	64	$524
Mainstreet Computer Corp.	Balance II	640x352	4	16	$NA
Number Nine	Revolution	512x480	256	256	$1995
Paradise Systems	Modular Graphics Card	640x400	16	16	$395
Profit Systems	Multigraph Plus	640x400	16	128	$595
Sigma Designs	Color 400	640x400	16	128	$795
	Dazzler	640x400	16	256	$895
	Dazzler 2	640x400	16	256	$995
Techmar	Graphics Master	640x400	16	128	$695
Vectrix	VX/PC	672-480	512	384	$2995

CONCLUSIONS/RECOMMENDATIONS:

It is recommended that the MDC configuration be expanded to include five ATCBT authoring systems and two draft quality graphics printers for command-wide implementation. Five systems will also provide a margin of safety so lesson production and maintenance will not be hampered due to potential system downtime.

2.3.3.2 Data/File Storage

ISSUE:

Authoring on floppy diskettes is time consuming, causes a backlog of disks and is impractical. Use of the hard disk configuration seems to be a more efficient use of file storage capability.

RESULTS:

The initial design of the authoring stations called for a dual floppy disk system with a virtual disk installed. During the evaluation, it was discovered that a one-hour lesson, with accompanying graphics, typically consumes up to 150K of memory, which is almost half of the 320K of memory normally available on a single floppy disk. However, authoring on floppy disks caused a backlog of file copies of disks and difficulty in tracking the current version of a lesson. This problem will only increase as the number of lessons and graphics continues to increase.

CONCLUSIONS/RECOMMENDATIONS:

All authoring stations should be upgraded to at least a 10 megabyte hard-disk configuration, if not a 21 megabyte disk. This configuration will eliminate the use of floppy disks as the primary authoring medium, and allow a file system to be established at each of the authoring stations. Floppy disks could then be used only to provide a backup of current work in case of power or equipment failure, rather than as the primary file storage facility. Another option that could be investigated for quick hard disk backup is a tape sorage back-up system. If even this amount of disk storage becomes a problem in the future, an option might be to install external hard disk drives.

2.3.3.3 Power Disruptions

ISSUE:

The MDC, in their present location at Travis AFB, have been subject to power outages due to circuit overloads internal to their building and to external power line downings during winter storms.

RESULTS:

These power outages have significantly impacted lesson authoring with estimates of up to one man-week of work lost per MDC person. Since any file that was open (whether lesson or graphic or test data) is lost when a power outage occurs, with an additional risk of hard disk crashes and subsequent damage, the potential loss warrants attention.

There are Uninterruptable Power Supplies (UPSs) that provide frequency-stable, constant voltage in response to disturbances on incoming lines. A UPS consists of a battery charger, batteries, and an inverter. Some UPSs are only activated when a frequency shift or a blackout occurs. Others require that the battery charger be left on. Likewise, some systems provide no break or interruption in the power supply. Others break power for a few milliseconds when transferring to the battery backup.

The price for a 500 VA UPS, which should provide sufficient power for a hard disk drive PC configuration, ranges from $400.00 to $1400.00. Battery power is typically available for 10 to 20 minutes, which should be ample time to finish work, save files, and shut down the system. The specific operating characteristics of the various models on the market need to be examined further before making a specific purchase suggestion.

CONCLUSIONS/RECOMMENDATIONS:

An uninterruptable power supply for each workstation would avert the lost time and potential equipment damage due to power blackouts.

2.3.4 Lesson Production, Maintenance, and Management

There are several issues related to the production, maintenance, and management of CBT lessons as the number of lessons in the inventory increases and the number of aerial ports online increases. These issues focus on the allocation of personnel resources at the MDC and the development of procedures to manage the CBT lesson inventory.

2.3.4.1 Lesson Production Schedule

ISSUE:

As an OPR, the MDC staff will be tasked with producing a substantial number of CBT lessons during command-wide implementation, as well as maintaining the CBT lessons that are already disseminated to the field. The requirement to collect lesson revision data and update lessons on a quarterly basis will become more time consuming as the number of lessons in the inventory increases.

RESULTS:

In order to build the CBT lesson inventory for command-wide implementation, ISD, Inc. will be tasked to develop many of the CBT lessons for the inventory during the follow-on contract period. ISD, Inc. personnel will design, develop, and validate lessons. The lessons will then be delivered to the MDC for inclusion in the inventory and dissemination to the field.

CONCLUSIONS/RECOMMENDATIONS:

To minimize the impact on MDC personnel resources, ISD, Inc. will utilize subject matter specialists from HQ MAC staff, ATTC instructors, and Travis aerial port squadron supervisors as required in the lesson design and review process.

2.3.4.2 Personnel Resources

ISSUE:

Given the current MDC staffing level and tasking and the requirements for producing and maintaining CBT lessons for command-wide implementation, the MDC personnel resources assigned to CBT lesson development may be insufficient to meet the schedule.

RESULTS:

The ATCBT authoring environment was designed to prompt a subject matter specialist through the authoring process, so a minimal amount of training would be required. ISD, Inc. will provide the MDC with an updated authoring/editing user guide during command-wide implementation. This could be used to train the ATTC instructors in CBT lesson design and development. In addition, a number of the ATTC instructors participated in review meetings during the design of the ATCBT authoring environment and development of the prototype CBT lessons and in the training workshops conducted at the MDC during the evaluation period.

CONCLUSIONS/RECOMMENDATIONS:

Since the MDC is co-located with the ATTC and both organizations report to the 1492 ATTF, it may be feasible to augment the MDC authors with ATTC instructors to develop CBT lessons. It is also recommended that three delivery stations be installed in the ATTC classrooms to provide students and instructors access to the CBT lessons.

2.3.4.3 Lesson Management

ISSUE:

The MDC will be the OPR for the ATCBT lesson inventory. As OPR, they will be responsible for activities such as assigning lesson designators, monitoring status of lesson development, performing quality control, maintaining a library of graphics, disseminating new lessons to the field, collecting and consolidating revision comments, analyzing test item data, revising lessons, and sending quarterly lesson updates. In addition, the MDC will be responsible for ensuring that all of the consumables (i.e., diskettes and mailers) required to support the program are available.

RESULTS:

Procedures need to be established for managing the CBT lesson inventory. For example, lesson updates which occur in response to comments from the field, test item analysis, and/or changes in subject matter need to be edited and disseminated to the ATCBT installations. In fact, the "Introduction to PACS" lesson developed for the prototype evaluation currently requires an update to reflect a change in function in the PACS keyboard. Likewise, new lessons, whether they are MDC-developed or contractor-developed, will need to be sent

out to installations. Procedures for disseminating CBT lessons need to include at least the following steps.

1. Copy the updated or new lesson(s) and picture files onto floppy disks.

2. Construct a batch (.BAT) file that will cause the files to be copied automatically to the appropriate subdirectory at the delivery stations so that ULC monitors need not know MS-DOS copy and delete commands.

3. Update the lesson management data files for the ULC to reflect new lesson(s).

4. Mail the copies to the ULCs with a distribution letter and installation instructions.

As discussed in Section 2.2.2.2, there is a requirement for an ATCBT catalog of lessons for the ULC and supervisors in the field. It is unclear whether the quarterly updates of the HQ AFRES Transportation Training Program Catalog are of sufficient detail to meet the requirements. The implications of developing a catalog based on the lesson specifications prepared for each CBT lesson should be explored.

The MDC staff has already addressed a number of lesson management issues. They are using a Z100 to support some of the recordkeeping functions, such as assigning lesson designators, recording development time, establishing in-house quality control procedures.

CONCLUSIONS/RECOMMENDATIONS:

It is recommended that the MDC develop a detailed set of procedures for managing the CBT lesson inventory. ISD, Inc. will provide suggestions and assistance in defining procedures as required. The procedures for CBT lesson management need to be incorporated into the ATCBT User Guide.

SECTION 3.0

COMMAND-WIDE IMPLEMENTATION PLAN

This section presents the proposed plan for command-wide implementation of the ATCBT system. The plan is based on the requirements in the contract Statement of Work, the results and recommendations of the prototype ATCBT system evaluation, and discussions with HQ MAC personnel. It represents the best efforts of ISD, Inc. to specify all of the events which must occur and propose a tentative schedule to accomplish these events. Implementation of the plan is subject to approval by HQ MAC.

The proposed schedule is presented in the first subsection to serve as a framework for discussing the events which must occur for command-wide implementation. The discussion of events, organized by the three components of the ATCBT systems--delivery, management, and production--follows.

3.1 Proposed Schedule

The scope of the command-wide implementation is to install ATCBT systems at 41 sites worldwide with an inventory of approximately 200 hours of CBT instruction to provide initial, recurring, and upgrade training for AFSC 605XX personnel. The schedule for command-wide implementation is based on the period of performance for the option years of the ISD, Inc. contract. As shown in Figure 3-1, the projected start date is 1 April 1986. This date is intended to allow time for report review and revisions, approval by HQ MAC, and initiation of subsequent contract delivery orders to perform the implementation tasks. The completion date, 15 February 1988, is the end date for the ISD, Inc. contract.

The schedule in Figure 3-1 is organized by the events for each of the ATCBT system components. As shown, there are a number of concurrent events across components which must be completed within the first three to six months. Some of these events are in preparation for command-wide implementation. These include the site survey and the development of the Information Systems Requirement Document shown under the delivery component events. Some of the events are required to implement revisions resulting from the operational test and evaluation of the components. These include revisions to the data management routines, expansion of the CONTROL software, and updates to the user documentation/training shown under the management component events.

To ensure that the revisions are integrated and the ATCBT system is operationally ready for command-wide implementation, a field test is planned for months 4 and 5 (1 July 1986 to 31 August 1986). After the field test is completed, the remaining command-wide installations are scheduled to begin. As shown in Figure 3-1, seven of the 41 sites will be installed at the end of the field test (31 August 1986) and all 41 sites are planned for installation by the end of the contract period (15 February 1988). The numbers shown in parentheses on the timeline for worldwide implementation represent the total number of site installations planned for completion at that point in the schedule. As shown, 11 are planned by 30 November 1986, 19 by 31 March 1987, 26 by 30 June 1987, 33 by 30 September 1987, 36 by 31 November 1987, with the remaining five completed by 15 February 1988. Section 3.2.4 provides the detailed implementation plan.

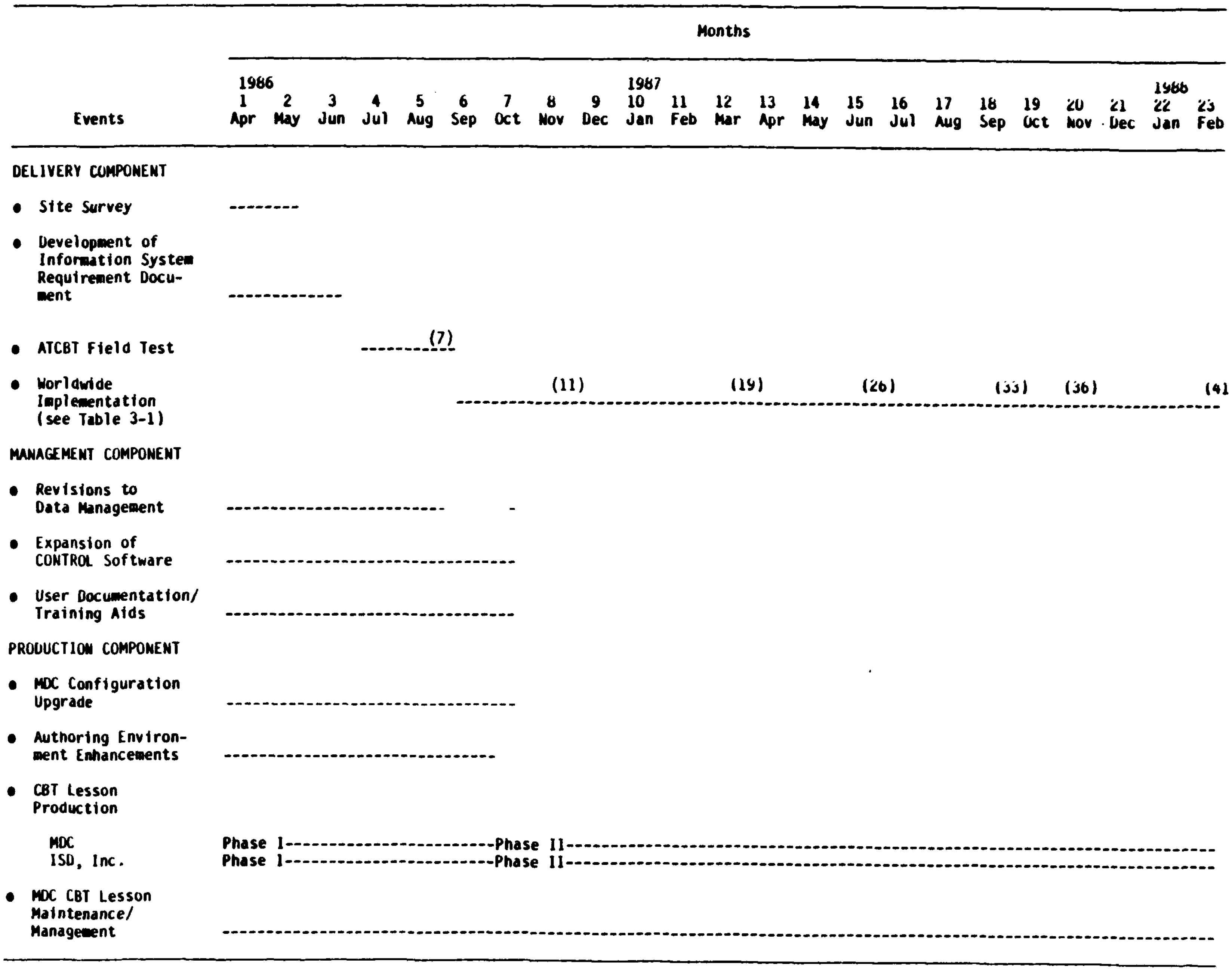


Figure 3-1. Schedule for Command-Wide Implementation

In order to support the CBT lesson production and maintenance requirements for command-wide implementation, the hardware/software configuration at the MDC needs to be expanded and upgraded and the authoring environment needs to be enhanced. A period of six months (1 April 1986 through 30 September 1986) is scheduled for the MDC hardware/software configuration upgrade.

A period of six months (1 April 1986 through 30 September 1986) is scheduled for enhancements to the authoring environment. Of course, this schedule assumes that the software upgrades are approved. As shown in the figure, this event will be performed concurrently with the initial CBT lesson production and maintenance events. A number of enhancements to the current authoring prototype have already been identified, but more will surface as new lessons are being developed. It is anticipated that most of the improvements will be identified and can be implemented during this six-month period.

To meet the objective of producing and disseminating approximately 200 hours of CBT instruction during command-wide implementation, a joint CBT lesson production effort is required. As shown in Figure 3-1, both the MDC and ISD, Inc. are scheduled to develop lessons concurrently during the implementation period. Phase I in the schedule represents the target of having approximately 60 hours of CBT instruction in the field by 30 September 1986. Phase II in the schedule represents the period for producing the approximately 140 hours of instruction that remain. As shown, CBT lesson maintenance and management is an ongoing MDC activity beginning with command-wide implementation.

3.2 Delivery Component

There are four events scheduled for command-wide implementation of the delivery component: (1) a survey of all the installation sites, (2) the development of the Information Systems Requirement Document, (3) the ATCBT field test, and (4) worldwide implementation. Each of these events is described in detail below.

3.2.1 Site Survey

An ATCBT survey must be disseminated to all of the command-wide implementation sites within the first ten days of contract start. The purpose of the survey is to: (1) solicit specific information about the installation site, (2) specify the facilities preparation which must be accomplished at the site prior to installation, and (3) define the maintenance responsibilities.

The information to be solicited from the sites includes, but is not limited to:

1. Work Force Description. Total number of personnel on site requiring AFSC 605XX training, broken down by shifts and work centers.

2. Work Center Locations. Identification of specific buildings and work centers within buildings where an ATCBT delivery station is required.

3. Communications Systems Requirements. Type of system, type of lines, responsible organization for on-base system.

4. Specific Points of Contact. Name, title, and phone number for personnel responsible for ATCBT implementation.

5. Tentative Schedule. Time constraints (i.e., inspections or exercises) that might impact implementation schedule.

The facilities preparation information to be provided to the sites includes, but is not limited to:

1. General Communication Requirements. Class C lines are needed to send data, using dial-up modems, from several remote points on base to the ULCs. The Class C lines should meet standard private line requirements for voice grade circuits. These requirements are:

   - o C message noise should be less than 31 dB RNC at the zero data level point

   - o Impulse noise at no more than one hit in one minute at the zero data test level

   - o Signal-to-noise ratio at about -45 dB for modem receive sensitivity

   - o RJ-11 modular telephone jack connector

   If these requirements cannot be met by Class C lines, then dedicated lines may be used. Specific requirements will be issued for each site as locations for terminals are identified.

2. General Power Requirements. Grounded outlets should be provided at each work station where terminals will be placed. The area should be isolated as much as possible from electrical noise and devices which cause excessive voltage level variations. Care should be taken to eliminate areas which are not rated for the power use required. For non-CONUS sites, transformers to allow 110 VAC, 60 Hz operation should be provided by the squadron. One transformer per terminal should be provided with a rating of 2000 watts or higher.

3. Space Requirements/Environmental Factors. The ATCBT computer should be placed in a relatively dust-free place. Airborne dust, dirt, and smoke can cause excess wear on moving surfaces, short circuits (especially in the presence of high humidity), and cause read/write errors on the disk. A cleaning kit needs to be available for use at each site.

   The ATCBT computer should be placed away from heat and direct sunlight. Unusually high temperatures coupled with low humidity can cause static problems. Normal temperature operating range is 10 to 40 degrees centrigrade with humidity variations of 10 to 95%.

   The front and rear panels of the ATCBT computer should not be obstructed. The computer is cooled by a fan located on the rear panel. This fan pulls air in through air inlets on the base of the system. The base of the system should be kept clear of papers or other materials that could obstruct air flow.

The system should not be placed in a small enclosed area. The system dissipates 140 watts (477.7 BTU/hour) which may be enough to raise the temperature beyond the maximum allowed if enclosed in a small area. This will also decrease the air flow around the system.

Each work station needs space for a standard desk or table-size desk, or a learning carrel, on which to place the terminal and still provide working room. An area for adjunct learning materials is needed at each ATCBT work station.

4. Support Materials. The following items should be available: anti-static mats for work stations with nylon carpet, surge protectors for each station (CONUS only), security measures as deemed appropriate, cleaning kits, small portable vacuum, printer paper and ribbons, floppy disks, floppy disk storage files.

The maintenance responsiblities need to be defined for the sites in terms of the following:

1. Each site has ownership of the training systems.
2. Support available from HQ MAC and other support organizations.
3. Explanation of warranty.
4. Description of preventive and corrective maintenance responsiblities.
5. Procedures for Form 9's.
6. Specifications for local maintenance support.

3.2.2 Information Systems Requirement Document

Based on the results of system evaluation presented in Section 2.1, the minimum requirements for the ATCBT system are listed below. Since the ATCBT software (including the delivery, management, and production components) is transportable across a family of PC compatible microcomputers, it does not matter which system is procured.

Delivery Station Characteristics:

- MS-DOS version 3.1 or later
- Color graphics monitor (320x200 resolution)
- Color board
- 640K RAM
- 21 megabyte hard disk drive with one floppy disk drive
- Keyboard
- Parallel port
- Serial port
- At least three additional slots for internal modem, over board, and other add-ons
- Calendar clock

Modem:

- CCITT protocol for non-CONUS
- Bell 212 for CONUS
- Blind dialing (does not wait for dial tone) for non-CONUS
- Receive sensitivity at least -45 dBm
- Transmit sensitivity at -10 dBm

- Automatic answer setting
- DTR always on setting
- IBM PC compatible
- RJ-11 jack connector

The plan is to procure the hardware for command-wide implementation under the Air Force standard microcomputer buy. Since the system available under the standard buy is an IBM AT clone rather than an IBM PC clone, it meets or exceeds the minimum requirements for the ATCBT system.

3.2.3 ATCBT Field Test

The purpose of the prototype evaluation was to field test the design of the ATCBT system components. The purpose of the field test is to ensure that all of the system revisions and enhancements identified as a result of the prototype evaluation are integrated and operationally ready for command-wide implementation. A period of two months is scheduled for the field test in order to shake out system "bugs and glitches" in an operational environment. In this way, any fixes to the revised software and changes to the updated user support documentation can be incorporated before worldwide implementation begins.

The field test is scheduled to begin 90 days after contract start to allow sufficient time to implement and test the software revisions for the management component, document procedures and prepare training/job aids, provide lead time to schedule hardware delivery, and prepare facilities at the test sites.

The seven sites listed below are scheduled for the field test.

1. 1492 ATTF (MDC and ATTC)
2. Travis AFB, CA
3. Oakland International Airport, CA
4. San Francisco International Airport, CA
5. Los Angeles International Airport, CA
6. Norton AFB, CA
7. Dyess AFB, TX

The field test also supports the events occurring in the production component during the first six months. It provides the opportunity for the MDC to go into a full-scale CBT lesson production/maintenance/management mode. Procedures for lesson dissemination, revision, and updating can be tested and documented. In addition, approximately 50 to 60 hours of CBT instruction will be completed by the end of the field test. This provides a substantial CBT lesson inventory at the start of worldwide implementation.

3.2.4 Worldwide Implementation

The strategy for worldwide implementation is to cluster sites by geographic location to facilitate scheduling and minimize travel costs. The site installation team consists of ISD, Inc. and HQ MAC personnel. The size of the installation (number of stations) determines the number of personnel and the time required at each site. For planning purposes, one week per site and three to six personnel per cluster (depending on the number of sites) is estimated.

Table 3-1 presents a tentative schedule for the 41 sites to be implemented worldwide. It lists the sites by cluster in the proposed order of installation. Tentative dates are identified for each cluster, as well as an estimate of the number of stations for each site. Both the order of the clusters and the sites within each cluster are subject to approval by HQ MAC.

As shown, Cluster 1 represents the sites selected for the field test. This cluster includes two of the four prototype evaluation sites. Clusters 2 and 3 include the remaining two prototype evaluation sites. Since the standard buy microcomputer will be procured for command-wide implementation, the decision was made to replace the AT&T 6300 computers currently in the field early in the schedule. This will standardize the field configuration and minimize maintenance requirements. The plan is to upgrade the AT&T 6300 computers as required and use them for authoring and as stand-alone stations.

The tentative dates are subject to change due to a variety of factors. These include, but are not limited to, lead time for hardware procurement, vendor delivery schedule delays, lead time for site preparation, completion of base communication requirements, and non-availability of site personnel due to inspections or exercises. An interval of two to four weeks is planned between each cluster to allow scheduling flexibility. Also, some flexibility needs to be provided to allow time to revisit a site within a cluster if unique, unanticipated operational problems occur.

Table 3-1 also shows the estimated number of stations per site. The number of stations is for planning purposes only. The actual number of stations will be determined on the basis of the site survey to be distributed for command-wide implementation. The number of stations was determined by a three-step process:

1. Identify the number of separate work stations at each site.

2. Determine the number of 605XXs at each separate work station.

3. Decide how many terminals should be located at each separate work station.

This process takes into account remote work station locations, as well as total throughput, in order to preclude travel by potential users to the primary work centers. The determination of size and work stations was based on an initial survey conducted in January 1985. For those aerial ports for which no surveys were received, numbers were extrapolated from similar sized aerial ports with similar missions. Total throughput was used to determine additional delivery stations, in that more than 126 605XXs at any one work station during any one shift would require two terminals. (This does not account for AFRES personnel who are potentially additional systems users.) This cutoff figure was based on the following four assumptions:

Table 3-1

Tentative Installation Schedule for Command-Wide Implementation

Cluster Sequence	Sites in Cluster	Estimated Number of Stations	Tentative Dates
1	1492 ATTF (includes MDC and ATTC)	8	Field Test
	Travis AFB, CA	6	01 Jul 86
	Oakland International Airport, CA	1	31 Aug 86
	San Francisco International Airport, CA	1	
	Los Angeles International Airport, CA	1	
	Norton AFB, CA	6	
	Dyess AFB, TX	3	
2	Charleston AFB, SC	7	08 Sep 86
	Pope AFB, NC	4	26 Sep 86
3	Rhein Main AB, Germany (includes PRC)	8	22 Sep 86
	Ramstein AB, Germany	5	10 Oct 86
4	McGuire AFB, NJ	5	12 Jan 87
	John F. Kennedy International Airport, NY	1	30 Jan 87
	Philadelphia International Airport, PA	1	
	Dover AFB, DE	6	
	NAS Norfolk, VA	2	
	Andrews AFB, MD	3	
5	Little Rock AFB, AR	5	16 Feb 87
	Altus AFB, OK	3	06 Mar 87
6	McChord AFB, WA	5	06 Apr 87
	Elmendorf AFB, AK	5	01 May 87
	Ellison AFB, AK	1	
	Hickam AFB, HI	5	
7	Scott AFB, Il (includes PRC)	4	18 May 87
	St. Louis International Airport, MO	1	05 Jun 87
	Howard AFB, Panama	5	
8	RAF Mildenhall, UK (includes 5 MAPS and 313 APS)	5	06 Jul 87
	Prestwick, Scotland	2	31 Jul 87
	Torrejon, Spain	2	
	Rota, Spain	2	

Table 3-1 (Continued)

Cluster Sequence	Sites in Cluster	Estimated Number of Stations	Tentative Dates
9	Aviano AB, Italy	2	31 Aug 87
	NAS Sigonella, Italy	2	18 Sep 87
	Naples, Italy	2	
10	Incirlik, Turkey	2	19 Oct 87
	Hellenikon AB, Greece	2	13 Nov 87
	Lajes Field, Azores	2	
11	Kadena AB, Japan	6	04 Jan 88
	Clark AB, Phillipines	6	31 Jan 88
	Anderson AFB, Guam	4	
	Yokota AB, Japan	6	
	Osan AB, Korea	5	

		152	

1. Each person takes at least one lesson a week.

2. There would be 75% usage at any one terminal with 25% of total availability used for transition time and for downtime.

3. Therefore, over a 24-hour period, 18 people would be able to take one one-hour lesson.

4. The stations would be continuously used seven days a week.

The conclusion is that 126 people could take one lesson a week on any one delivery station. The most critical factor in determining the required number of delivery stations proved to be location of the work station. Many stations are physically removed from each other, thus the implication is that each station needs their own microcomputer.

3.3 Management Component

Three events are scheduled for command-wide implementation of the management component: (1) revisions to the the data management routines, (2) expansion of the CONTROL software, and (3) updates to the user documentation and training aids. Each of these events is described in detail below.

3.3.1 Data Management Revisions

As described in Section 2.2.1, a number of revisions need to be incorporated into the data management routines. These include major revisions to the training management reports to make them more useful to the OJT supervisors, section supervisors, and ULC monitors. They also include simplifying the procedures for ULC monitors to input database information and generate reports. Based on the recommendations from the prototype evaluations, the following changes are planned for the training information management reports:

1. Revise the completion report to provide a record of the trainee progress through the parts of a lesson, including segment and lesson exam scores and dates. Delete the report to the student.

2. Provide a list of personnel currently registered on the ATCBT system.

3. Correct the problems encountered in the CBT utilization data report.

4. Reconsider the use of the list of students which shows no activity in the system for a specified period of time.

5. Provide a history file for each student registered on the system.

The requirement for an on-line query capability at the work station needs to be further defined in order to determine the scope of the revisions. Likewise, the capability for supervisors to input lesson revision comments on-line needs to be reviewed to determine its impact during command-wide implementation.

Once the requirements are identified, the interfaces and procedures for inputting database information and generating reports can be simplified. The format for the data can be defined more clearly for faster entry and the processing procedures can be streamlined and made more specific. The goal is to make the ULC monitor data management tasks as efficient as possible through software enhancements. The requirement to document the revisions is discussed in Section 3.3.3 below.

3.3.2 CONTROL Software Expansion

The ATCBT CONTROL software (an ISD, Inc. product) operates "underneath" the MS-DOS software (a MicroSoft Corp. product). CONTROL controls the ATCBT events that occur. It resides as a monitor to tell CDS (a product of EIS, Inc.) when to run a lesson; it moves files from hard disk to virtual disk to executable RAM, determines when and where to get the lessons, determines when and where to send data, determines the status of communication lines, allows administrative actions (protected from students) for data management actions, and issues commands to MS-DOS.

Currently, CONTROL is designed to handle commercial communication lines, Class A lines, Class C lines, and null modems. Expansion of its capabilities to handle dedicated lines and integrated digital lines is needed to support command-wide implementation in cases where those specialized lines are required. It is planned to (1) incorporate more error correction to accomodate noisy lines on bases, (2) provide an on-line testing monitor to check line

quality, and (3) enhance the interface to users for setting communication parameters and configuring the system. Other expansions which may be necessary include support for a data query from supervisors at remote terminals.

3.3.3 User Documentation/Training Aids

The ATCBT User Guide must be updated to reflect the revisions in process and procedures described in Section 2.2. These include the operating instructions and procedures developed and validated using the prototype evaluation, as well as the modifications to be made prior to and during the field test. The revised ATCBT User Guide needs to (1) determine the format and use of the ATCBT student history file (i.e., printed reports included in training records, out-processing documents sent downline to next duty station, etc.), (2) establish the policy for retaining training data at the ULC, (3) establish ownership of the equipment and specify the maintenance management policy (i.e., can Air Force-wide small computer maintenance contracts be used or do local on-call agreements need to be made?), (4) provide guidelines (as dictated by HQ MAC) on the availability of organizational resources at the squadron, base, Numbered Air Force, 1492 ATTF, and HQ MAC levels, as appropriate, (5) detail the procedures for the MDC and the ULC for lesson dissemination, maintenance, and management.

Based on the results of the prototype evaluation, a variety of easy-to-use training/job aids need to be implemented for the ATCBT system users. These job aids need to extend beyond the ULC monitors to the OJT and section supervisors, the trainees, and to the MDC in their role of providing operational support to the field. They range from simple instructions on use of the keyboard placed on the training terminal at the work station, to a list of adjunct materials required to support the CBT lessons in the inventory, to the step-by-step procedures for reformatting the hard disk to recover from crashes.

3.4 Production Component

The events scheduled for command-wide implementation of the production component are: (1) MDC configuration upgrades, (2) enhancements to the authoring environment, and (3) full-scale CBT lesson production and maintenance. Each of these events is described in detail below.

3.4.1 MDC Configuration Upgrade

The proposed configuration for the MDC production component is listed below. Paragraphs from Section 2.3 are referenced in parentheses after each item to reiterate the need for the upgrade.

- Five (5) authoring stations (2.3.3.1 and 2.3.3.2)
- Two (2) draft quality printers (2.3.3.1)
- Five (5) uninterruptable power supplies (2.3.3.3)
- Three (3) copies of Dr. Halo II graphics software with Summagraphics MM series digitizer tablet and input devices (2.3.2.2)
- One (1) PC Eye digitizer system (2.3.2.2)

- Five (5) copies of latest version of CDS II authoring software (2.3.1.4 and 2.3.2.3)
- Five (5) copies of CDSX run-time software (2.3.1.5)
- Five (5) copies of CONTROL software (2.3.1.5)

The software upgrades need to be implemented as quickly as possible. This is to minimize the requirement to convert CBT lessons developed using the current version of CDS II authoring software and graphics development software when upgrade does occur. Also, the proposed enhancements to improve the efficiency of the authoring environment cannot be started until the software upgrades are in place. The authoring software upgrades are commercially available; thus, minimal lead time is required. The hardware upgrade may require 60 to 120 days lead time for installation; thus, a period of six months is scheduled. However, the sooner the hardware upgrade can be accomplished, the easier it will be for the MDC staff to meet their production requirements.

3.4.2 Enhancements to the Authoring Environment

As discussed in Section 2.3.1, the authoring prototype can be enhanced in several ways. The modifications to the prompts in the current prototype should be implemented immediately. Once the upgrade to the CDS II software has been implemented at the MDC, a number of features can be added to the authoring prototype. These include running programs external to CDS II, use of graphic commands within CDS II, access to alternate text sizes, and screen-based text entry. Furthermore, additional prototypes using these new features can be developed for specialized topic areas, such as PACS screen masks and ADAM III displays. The Production Component User Guide must also be updated to reflect the modifications and enhancements to the authoring prototype.

3.4.3 CBT Lesson Production and Maintenance

As described earlier, the production of approximately 200 hours of CBT instruction is a joint effort between the MDC and ISD, Inc. The priority for lesson topics to be developed for command-wide implementation was established by HQ MAC and the MDC. Top priority was given to those STS items for which no formal training material (i.e., slide/tape, programmed text) currently exists. The STS items for which training materials already exist were given a lower priority for development. The assignment of lesson topics for contractor development was determined by HQ MAC and the MDC. The MDC staff is responsible for developing approximately 72 hours of instruction, while ISD, Inc. is tasked with developing approximately 120 hours of instruction. The MDC staff is also responsible for maintaining the nine prototype lessons, as well as all of the new lessons as they are added to the inventory.

The schedule for producing the lessons is divided into two phases. By the end of Phase I, approximately 60 hours of CBT instruction will be in the inventory. This includes 20 to 24 hours developed by the MDC and 30 hours developed by ISD, Inc., plus the nine hours for the prototype lessons. The lesson topics to be developed by the MDC during Phase I are listed in order of priority in Table 3-2. The lesson topics to be developed by ISD, Inc. during

Phase I are listed in order of priority in Table 3-3. The remaining hours of CBT instruction (approximately 140) will be developed during Phase II. Table 3-4 lists the lesson topics to be developed by the MDC, while Table 3-5 lists the lesson topics to be developed by ISD, Inc. during this period.

Phase II lessonware production by ISD, Inc. is subject to further definition and verification by HQ MAC. The emphasis, priority, and actual topics for CBT production can change due to a number of circumstances, including HQ MAC's response to comments from the field regarding lessons that are desired/needed for OJT.

The number of lessons scheduled for MDC production in Phase II has been reduced due to the increased requirements for lesson maintenance. With 60 hours of instruction in the field and more being developed, the amount of time required by the MDC staff to maintain and manage the CBT lesson inventory will increase significantly.

Table 3-2

Topics for Phase I
CBT Development by the MDC

Lesson Topics	Related STS Items	Estimated Hours
Anti-Hijacking/Terminal Security	60530; 12	1.0
Inflight Meal Procedures	60530; 9f	1.0
Introduction to ADAM III	60531: 15a, b, 9	1.0
Joint Inspection, DD Form 2133	60531; 10n	2.0
Determine Passenger Eligibility	60530; 8b(1)	3.0
Issue and Account for Supplies and Equipment	60531; 13b(1)-(3)	1.0
Mobility Work Centers	60531; 7a, b 60530; 7a, b	4.0
Maintain Mission Folder, Logs, Trip Set-Up Sheets, and Record Work Center Activities	60531; 11d	1.0
Flight Schedules and Updated Messages	60531; 11a	1.0
M-Series Vehicles (1 hour/vehicle)	60531; 8a(8), 8b(8)	5.0
Process Unique Passengers	60530; 9i	2.0
	TOTAL	22.0

Table 3-3

Topics for Phase I
CBT Development by ISD, Inc.

Lesson Topics	Related STS Items	Estimated Hours
PACS Processing		
Processing 1	60530; 8a(1)(c), 8b	2.0
Processing 2	60530; 8b, 9a, 9e	3.0
Processing 3	60530; 9d, 10b, 8a(1)(c), 10a(1), 14	3.0
Processing 4	60530; 14	1.0
Center of Balance Markings and Computations	60531; 10i(1) (2)	2.0
Calculate Placement of Cargo in Aircraft and Complete Actual Weight and Balance Forms	60531; 11i(1) (2)	4.0
Process Passenger, Travel Restrictions, Border Clearance	60530; 9a, b	2.0
Wide Body Cargo Loader	60531; 8a(9), 8b(9)	4.0
Cash Collection Procedures	60530; 9d	2.0
ADAM III		
Air Terminal Cargo Processing	60531; 10f(1) (2)	2.0
Process Surface Arriving Cargo	60531; 10	1.0
Load Planning	60531; 11f, h, j	1.0
Cargo Processing	60531; 10	2.0
Cargo Tracing and Visibility	60531; 9c(4) (5), 11g	1.0

		TOTAL 30.0

Table 3-4

Topics for Phase II
CBT Development by the MDC

Lesson Topics	Related STS Items	Estimated Hours
Fleet Service Equipment (1 hour/vehicle)	60531; 13c(1)-(3)	3.0
Process Cargo and Mail (Manifest)	60531; 10f(1), (2)	1.0
Inspect Shipments for General Markings	60531; 10a(1)	1.0
Frustrate Air Cargo Shipments	60531; 10b(1)	1.0
Frustrate Mail Shipments	60531; 10b(1)	1.0
Maintain Passenger Listings (Flight Setup)	60530; 8b(2)	3.0
Select Passengers for Movement	60530; 8b(3)-(5)	2.0
Security for Cargo and Mail	60531; 10f(3)	1.0
Maintain Logs	60531; 10f(4), (6)	1.0
On/Offload Using Aircraft Engine Running Procedures	60531; 12f	1.0
Process Passenger Baggage	60530; 9g	4.0
Store Shipments in Appropriate Place	60531; 10g	2.0
Re-Ice Shipment and Annotate	60531; 10f(5)	1.0
Documentation for Palletized Air Shipments	60531; 10k(1)-(3)	1.0
Passenger Bus	60530; 11a(3), 11b(3)	1.0
Maintain On-Hand Files and Make Air Terminal Inventories	60531; 11f, g	1.0
Mobile Boarding Staircase	60530; 11a(4), 11b(4)	1.0

Table 3-4 (Continued)

Lesson Topics	Related STS Items	Estimated Hours
Palletization of Cargo on 463L Pallets	60531; 10j(1)-(4)	1.0
Operate Scales to Weight Palletized Cargo	60531; 10j(5), (6)	1.0
Mobile Baggage Conveyor	60530; 11a(5), 11b(5)	1.0
Assemble Cargo and Mail for Loading Using Pre-Load Documentation	60531; 12a	1.0
Manifesting	60531; 11j(1)-(4)	3.0
Procedures for Loading and Offloading	60531; 12d(1)-(7)	1.0
Install/Remove Tie-Downs; Secure Cargo and Mail	60531; 12e(2), (3)	1.0
Briefing Aircrews	60531; 11c	1.0
4000-Pound Forklift	60531; 8a(2), 8b(2)	1.0
Warehouse Tug	60530; 11a(1), 11b(1), 60531; 8a(1), 8b(1)	1.0
Types and Methods of Airdrop	60531; 14b	1.0
Types of Airdrop Containers	60531; 14c	1.0
Types of Load Platforms	60531; 14d	1.0
Types of Extraction Systems	60531; 14e	1.0
Types of Parachutes	60531; 14a	1.0
Airlift	60531; 6a, b	1.0
-18 Air Conditioner (65 Ton)	60530; 11a(6), 11b(6)	1.0
Records, Reports, and Forms	60531; 9a-f	5.0
Records, Reports, and Forms	60530; 10	1.0
	TOTAL	51.0

Table 3-5

Potential Topics for Phase II
CBT Development by ISD, Inc.

Lesson Topics	Related STS Items	Estimated Hours
Organization and Mission of MAC	60531; 5	2.0
MAC Mobility Concept	60531; 7a	1.0
10K Forklift Operator Inspection, Maintenance, and Safety Procedures	60531; 8a(3), 8b(3), 60530; 11a(2), 11b(2)	5.0
Adverse Terrain Forklift (ATL)	60531; 8a(4), 8b(4)	6.0
10K AT Forklift (TEREX) Operator Maintenance and Safety		
10K AT Forklift (CASE) Operator Maintenance and Safety		
25K Loader Operator Maintenance, Inspection and Safety Procedures	60531; 8a(5), 8b(5)	5.0
40K Loader Operator Maintenance, Inspection and Safety Procedures	60531; 8a(6), 8b(6)	5.0
H-19 TAC Loader	60531; 8a(7), 8b(7)	6.0
Inflight Meal Procedures	60530; 9f	3.0
Perform Cargo/Mail Acceptance and Inspection	60531; 10a(2), 10a(5)	4.0
Inspect Shipments for Pilferage, Packaging, and Documentation	60531; 10a(6), 10a(7), 10a(8)	2.0
Hazardous Cargo Handler	60531; 10a(3), 10a(4)	9.0
Transportation Control and Movement Document (TCMD)	60531; 10d	8.0
Traffic Transfer Receipt AF Form 127	60531; 10e	4.0

Table 3-5 (Continued)

Lesson Topics	Related STS Items	Estimated Hours
In-Processing/Terminating Cargo	60531; 10l	7.0
Master 463L Pallet	60531; 10m	3.0
Load Message AM-9	60531; 11b	3.0
Load Planning	60531; 11h	9.0
Aircraft Load Shoring	60531; 12b	5.0
Cargo Tie-Down and Restraint	60531; 12e(1), 12e(2)	5.0

		TOTAL 92.0